ORDINANCE NO. 3638

(Establish Henderson Municipal Code Section 14.18.047 - West Henderson-Bermuda Wastewater Backbone Infrastructure Rates)

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF HENDERSON, NEVADA, TO ESTABLISH SECTION 14.18.047 – WEST HENDERSON-BERMUDA WASTEWATER BACKBONE INFRASTRUCTURE RATES – OF THE HENDERSON MUNICIPAL CODE.

WHEREAS, with the exception of the Inspirada master-planned community, the area generally bounded by Las Vegas Boulevard to the west, St. Rose Parkway to the north, the master-planned communities of Seven Hills and Anthem to the east, the Sloan Canyon National Conservation Area to the south ("West Henderson") is forecasted to increase in population by approximately 70,000 people by the year 2050; and

WHEREAS, between now and the year 2050, West Henderson is expected to add considerable new residential and commercial development, including both retail and industrial development projects; and

WHEREAS, Article II, Section 2.270 of the City of Henderson ("City" or "Henderson") City Charter gives the Henderson City Council (the "City Council") authority to provide for any part of a sanitary sewer system, extend sewer lines and "[e]stablish sewer fees and provide for the enforcement and collection thereof"; and

WHEREAS, Article II, Section 2.280.1(b) of the Henderson City Charter gives the City Council authority to provide for the construction of any facility necessary for the provision of wastewater service; and

WHEREAS, Henderson Municipal Code (HMC) Section 14.18.020.D provides that the assessment and collection of all fees and charges shall be made in accordance with the established procedures of the City; and

WHEREAS, in addition, Section 278.02591 of the Nevada Revised Statutes (NRS) allows a governing body to establish an analysis of the cost to construct infrastructure in an area which is undeveloped land and which is likely to become developed and NRS 278.02598 allows the governing body, through that analysis, to distribute equitably the infrastructure development costs among those persons who wish to develop the land; and

WHEREAS, the land in West Henderson is largely undeveloped and is likely to become developed; and

WHEREAS, wastewater backbone infrastructure must be constructed to enable the City to provide wastewater service in the West Henderson area; and

WHEREAS, on May 1, 2018, City Council approved amendment no.1 to an agreement between the City and Atkins North America, Inc. (the "Atkins On-Call Agreement") for increased engineering support services on an as-needed basis; and

WHEREAS, task order no. 26 to the Atkins On-Call Agreement was necessary to provide strategic infrastructure planning support to determine the wastewater backbone infrastructure required to provide wastewater service to approximately 6,890 acres of land within West Henderson based on then-existing zoning (the "West Henderson Study Area"); and

WHEREAS, the West Henderson Study Area is comprised of five (5) separate drainage basins referred to as the Bermuda, Gilespie, St. Rose, Las Vegas Boulevard and Airport Sewer Basins; and

WHEREAS the Bermuda Sewer Basin is comprised of approximately 4,135 acres and is depicted in Exhibit A, consisting of one page, (the "Bermuda Basin Boundary") and incorporated by reference herein; and

WHEREAS, to assist with West Henderson wastewater backbone infrastructure planning, including identifying the size, capacity and locations for the backbone sewer main construction phases and segments within the Bermuda Sewer Basin, Atkins North America, Inc. produced the West Henderson Sewer Study – Bermuda Basin, dated May 24, 2019, attached as Exhibit B, consisting of 31 pages, (the "Bermuda Basin Study") and incorporated by reference herein; and

WHEREAS, the Bermuda Basin Study identifies an estimated total quantity of wastewater contribution equivalent to Twenty-Six Thousand, Three-Hundred Fifty-Five (26,355) Equivalent Residential Units ("ERUs") within the Bermuda Basin Boundary and furthermore identifies nine backbone infrastructure segments that are required to be constructed to provide wastewater service to properties from that infrastructure; and

WHEREAS, to assist with identifying the estimated available capacities and costs for Segment 1, Segment 2, Segment 3 and Segment 9 (collectively, the "WH-Bermuda Wastewater Backbone Infrastructure"), Atkins North America, Inc. produced the West Henderson Phase 1 Wastewater Backbone Infrastructure Rate – Bermuda Sewer Phase 1 Analysis, dated August 29, 2019, consisting of 11 pages, the West Henderson Phase 2 Wastewater Backbone Infrastructure Rate – Bermuda Sewer Phase 2 Analysis, dated May 23, 2019, consisting of eight pages, (collectively, the "Bermuda Basin Rate Studies"), attached as Exhibit C and incorporated by reference herein; and

WHEREAS, the estimated available capacities for Segments 1, 2, 3 and 9 are as follows: 32,338 ERUs for Segment 1; 25,386 ERUs for Segment 2; 24,565 ERUs for Segment 3; and, 15,280 ERUs for Segment 9; and

WHEREAS, the Bermuda Basin Rate Studies identify the engineer's opinion of probable cost for the design and construction of the WH-Bermuda Wastewater Backbone Infrastructure to be approximately Five Million, Two Hundred Thirty-Six Thousand, Four Hundred Ninety-Nine dollars ($5,236,499.00) in 2019 dollars, which amount is comprised of One Million, Nineteen Thousand, Two Hundred Ninety-Seven dollars ($1,019,297.00) for Segment 1; One Million, Two Hundred Sixteen Thousand, Six Hundred Forty-Four dollars ($1,216,644.00) for Segment 2, One Million; Nine Thousand, Seven Hundred Fifty-Eight dollars ($1,009,758.00) for Segment 3; and One Million, Nine Hundred Ninety Thousand, Eight Hundred dollars ($1,990,800.00) for Segment 9; and

WHEREAS, after the Bermuda Basin Rate Studies were prepared, City staff received pricing from the contractor constructing Segment 3 and Segment 9 of the WH-Bermuda Wastewater Backbone Infrastructure as follows: One Million, One Hundred Seventy-Five Thousand, Three Hundred Thirty-Nine dollars ($1,175,339.00) for Segment 3; and One Million, Eight Hundred Ninety-Three Thousand, Three Hundred Sixty-Five dollars ($1,893,365.00) for Segment 9; and

WHEREAS, the City has determined that, although each customer is responsible for constructing and paying for wastewater backbone infrastructure, given the significant acreage and extensive coordination required to ensure orderly development, it provides a public benefit for the City to assume responsibility for planning and constructing the WH-Bermuda Wastewater Backbone Infrastructure and establishing rates for that infrastructure to enable the City to pay for this infrastructure through rates collected from customers who benefit from it (the "WH-Bermuda Wastewater Backbone Infrastructure Rates"); and

WHEREAS, the City may include all costs associated with the WH-Bermuda Wastewater Backbone Infrastructure, including the types of costs identified in HMC 14.16.050.A.5.a through HMC 14.16.050.A.5.f, when calculating the rates for that infrastructure; and

WHEREAS, in order for the City to recover the costs it has incurred and will incur to plan, design, construct and finance the WH-Bermuda Wastewater Backbone Infrastructure, the City shall establish specific rates, per ERU, with such rates being assessed to projects that benefit from the WH-Bermuda Wastewater Backbone Infrastructure; and

WHEREAS, the initial rate for the WH-Bermuda Wastewater Backbone Infrastructure shall be based on the cumulative benefit received from each segment of backbone infrastructure constructed and shall be $31.52 per ERU to connect to Segment 1, $79.45 per ERU to connect to Segment 2, $131.39 per ERU to connect to Segment 3 and $270.83 per ERU to connect to Segment 9, and may be adjusted to reflect actual costs; and

WHEREAS, in addition, NRS 278.02598 allows the City Council to distribute equitably the infrastructure development costs among those persons who wish to develop the land, and the wastewater backbone infrastructure is also part of the City's comprehensive plan for West Henderson infrastructure; and

WHEREAS, a Business Impact Statement was posted by the City of Henderson to collect comments on potential impacts of the required contribution created by the West Henderson wastewater backbone infrastructure rates; and

WHEREAS, the City of Henderson staff addressed the comments from the Business Impact Statement in the WH-Bermuda Wastewater Backbone Infrastructure Rates; and

NOW, THEREFORE, the City Council of the City of Henderson, Nevada, does ordain:

SECTION 1. The Bermuda Basin Study and Bermuda Basin Rate Studies are hereby adopted as the analysis of the cost to plan, design and construct the WH-Bermuda Wastewater Backbone Infrastructure and, together with actual costs of WH-Bermuda Wastewater Backbone Infrastructure designed and constructed, provide the basis for the City Council to fix the WH-Bermuda Wastewater Backbone Infrastructure Rates (defined in HMC 14.18.047.B).

SECTION 2. Section 14.18.047 - West Henderson Wastewater Backbone Infrastructure Rates - is established as follows:

14.18.047 - West Henderson-Bermuda Wastewater Backbone Infrastructure Rates

A. Planning and design of wastewater backbone infrastructure for West Henderson, construction of that infrastructure, financing of that construction, and phasing of that construction are required to support wastewater service to existing and future developments in the West Henderson area. The director has the right to determine the size and capacity of that wastewater backbone infrastructure, phasing of construction of that wastewater backbone infrastructure, and method of financing the construction, taking into account projected service needs of the West Henderson area served and the need for the orderly and efficient development of the publicly-owned treatment works.

Editor's Note: Pursuant to City Charter Section 2.090(3), language to be omitted is red and enclosed in [brackets], and language proposed to be added is in *blue italics and underlined*.

B. The rates charged to projects that the city determines will receive a benefit from segment 1, segment 2, segment 3 or segment 9 of the wastewater backbone infrastructure planned, designed, constructed, and/or financed for the Bermuda Sewer Basin within West Henderson are referred to as the "segment 1 wastewater infrastructure rate," "segment 2 wastewater infrastructure rate," "segment 3 wastewater infrastructure rate" and "segment 9 wastewater infrastructure rate," respectively, and, collectively, as the "WH-Bermuda backbone wastewater infrastructure rates." The WH-Bermuda wastewater backbone infrastructure rates shall be in addition to system development and other applicable charges for wastewater service.

C. Effective November 25, 2019, all new projects that the city determines will receive a benefit from existing or future wastewater backbone infrastructure planned, designed, constructed, and/or financed for the Bermuda Sewer Basin within West Henderson shall be charged and pay the segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate and/or the segment 9 wastewater infrastructure rate, as the city determines is appropriate. The amount(s) charged shall be based upon the total ERUs proposed for the project, as reflected in the civil improvement plans for the project approved by the city, and the rate(s) used will be the one(s) in effect on the date the city processes the building permit for the project or, if a project is not required to obtain a building permit from the city, at the rate in effect on the date the city approves the civil improvement plans for the project.

D. Any project that was initiated at the city before November 25, 2019 and whose approval was conditioned on the city being paid the rate(s) established or other amount charged by the city for existing or future wastewater backbone infrastructure planned, designed, constructed, and/or financed for West Henderson shall be charged and pay the segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate and/or the segment 9 wastewater infrastructure rate, as the city determines is appropriate. The amount(s) charged shall be based upon the total ERUs proposed for the project, as reflected in the civil improvement plans for the project approved by the city, and the rate(s) used will be the one(s) in effect on the date the city processes the building permit for the project or November 25, 2019, whichever is later.

E. Effective November 25, 2019, all projects that proceed with additional improvements to a property that result or might result in an increase in the amount of wastewater discharged to the publicly owned treatment works above that previously proposed – as reflected in the civil improvement plans, in the building permit or by other means of receiving city approval for such additional improvements – and that the city determines will receive a benefit from existing or future wastewater backbone infrastructure planned, designed, constructed, and/or financed for West Henderson shall be charged and pay the segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate and/or the segment 9 wastewater infrastructure rate, as the city determines is appropriate. Whether the improvements result or might result in an increase in the amount wastewater discharged to the publicly-owned treatment works above that previously proposed shall be determined by the director in his or her sole discretion. The rate(s) charged shall be based upon the increase in total additional ERUs associated with the property improvements and at the rate in effect on the date the city processes the building permit for the proposed improvements or, if a project is not required to obtain a building permit from the city, at the rate in effect on the date the city approves the civil improvement plans for the proposed improvements or provides its approval of the additional improvements by other means.

F. The initial segment 1 wastewater infrastructure rate shall be $31.52 per ERU. The initial segment 2 wastewater infrastructure rate shall be $79.45 per ERU. The initial segment 3 wastewater infrastructure rate shall be $131.39per ERU. The initial segment 9 wastewater infrastructure rate shall be $270.83per ERU. Initially, these rates have been based upon actual and estimated costs for the city to fund the planning, design, construction, and/or financing of the West Henderson wastewater backbone infrastructure. After construction of the particular segment is completed, the city manager may adjust the rate for that segment to reflect the actual costs to plan, design, construct, and finance the West Henderson wastewater backbone infrastructure in that segment. The city will identify the then-current segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate and/or the segment 9 wastewater infrastructure rate in the department service rules. Unless otherwise approved in writing by the director at his or her sole discretion, the rate(s) assessed shall be paid to the city when the city issues a building permit, prior to issuance of a certificate of occupancy or prior to commencement of permanent wastewater service, whichever is earliest.

G. For five (5) years after a certificate of occupancy is issued for a project or an improvement is made to a project, the city has the right to audit that project to confirm that the project's average annual wastewater discharge to the publicly owned treatment works is substantially the same as the total ERUs proposed for the project or project improvement. If the city determines the project is using more capacity of the West Henderson wastewater backbone infrastructure than proposed, the city may require the original developer of the project or project improvement, as applicable, to pay the difference between the total ERUs charged the project and total ERUs actually used at the property at the segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate and/or the segment 9 wastewater infrastructure rate, as appropriate, in effect on the date the city prepares a bill for the additional payment.

H. If the segment 1 wastewater infrastructure rate, the segment 2 wastewater infrastructure rate, the segment 3 wastewater infrastructure rate or the segment 9 wastewater infrastructure rate is adjusted after the city receives a payment, the city is not obligated to true-up the payment received or to refund/collect any difference.

SECTION 3. The Bermuda Basin Study and Bermuda Basin Rate Studies meet the applicable criteria established in NRS 278.02591.2.

SECTION 4. Each project must pay City that project's equitable share of the wastewater backbone infrastructure planned, designed, constructed, and/or financed for the West Henderson in accordance with the applicable procedure in HMC Chapter 14.18, the established procedures of the City and/or through a development agreement.

SECTION 5. If any section, subsection, paragraph, clause or provision of this Ordinance shall for any reason be held invalid or unenforceable, the invalidity or unenforceability of such section or subsection, paragraph, clause or provision shall not affect any of the remaining provisions of this Ordinance.

SECTION 6. All ordinances, or parts of ordinances, sections, subsection, phrases, sentences, clauses or paragraphs contained in the Municipal Code of the City of Henderson, Nevada, in conflict herewith are repealed and replaced as appropriate.

SECTION 7. A copy of this Ordinance shall be filed with the office of the City Clerk, and notice of such filing shall be published once by title in the Las Vegas Review-Journal, a newspaper having general circulation in the City of Henderson, at least ten (10) days prior to the adoption of said Ordinance, and following approval shall be published by title (or in full if the Council by majority vote so orders) together with the names of the Councilmen voting for or against passage for at least one (1) publication before the Ordinance shall become effective. This Ordinance is scheduled for publication on November 22, 2019, in the Las Vegas Review-Journal.

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Editor's Note: Pursuant to City Charter Section 2.090(3), language to be omitted is red and enclosed in [brackets], and language proposed to be added is in *blue italics and underlined*.

PASSED, ADOPTED, AND APPROVED THIS 19TH DAY OF NOVEMBER, 2019.

Debra March, Mayor

ATTEST:

Sabrina Mercadante, MMC, City Clerk

The above and foregoing Ordinance was first proposed and read in title to the City Council on November 5, 2019, which was a Regular Meeting, and referred to a Committee of the following Councilmen:

"COUNCIL AS A WHOLE"

Thereafter on November 19, 2019, said Committee reported favorably on the Ordinance and forwarded it to the Regular Meeting with a do-pass recommendation. At the Regular Meeting of the Henderson City Council held November 19, 2019, the Ordinance was read in title and adopted by the following roll call vote:

Those voting aye:

Debra March, Mayor
Councilmembers:
John F. Marz
Dan K. Shaw
Dan H. Stewart

Those voting nay: None
Those abstaining: None
Those absent: Michelle Romero

Debra March, Mayor

ATTEST:

Sabrina Mercadante, MMC, City Clerk

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Exhibit A
Bermuda Basin Boundary

Figure 2 - Sewer Basins

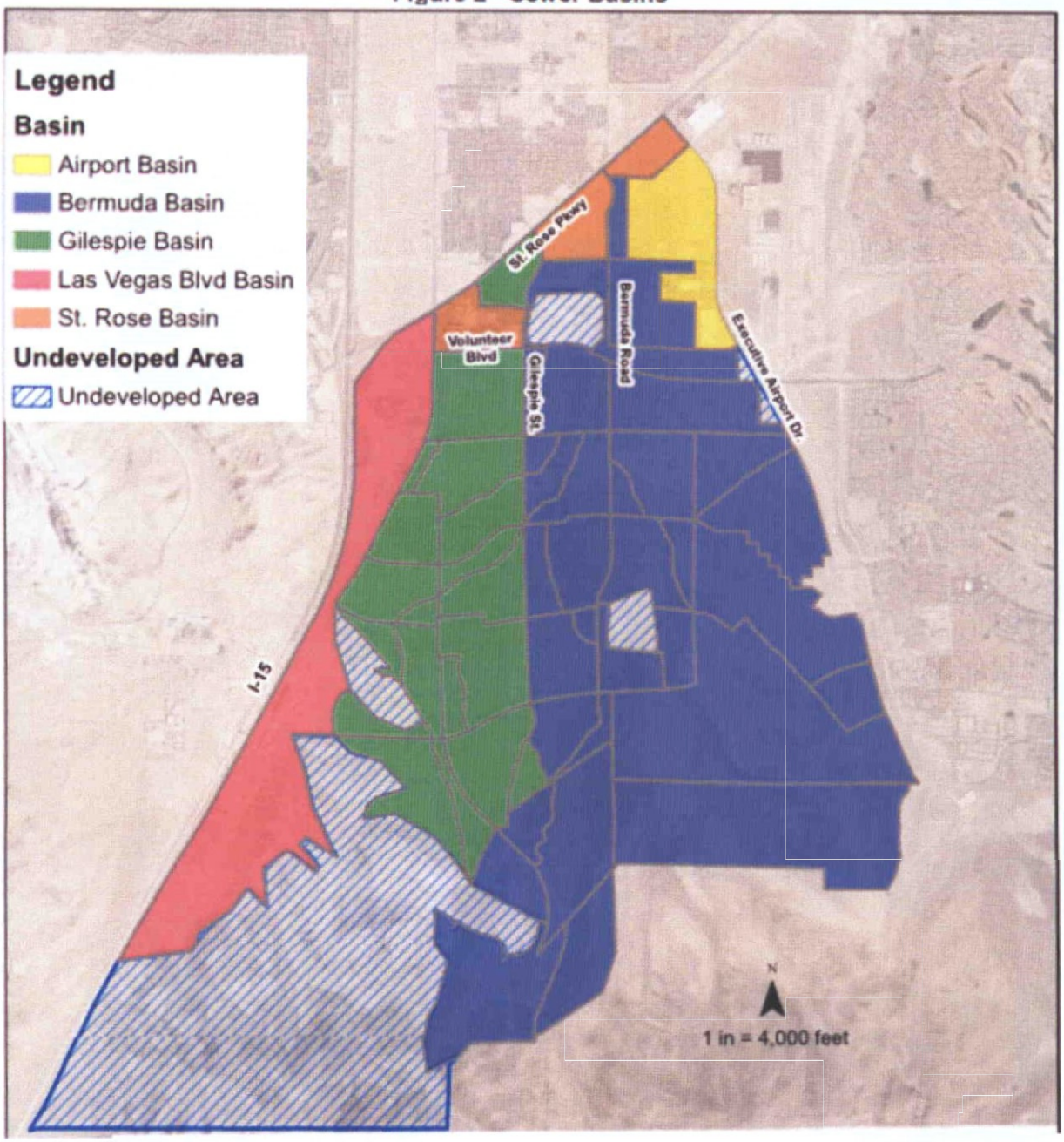

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Exhibit B

Bermuda Basin Study

[Attached]

SNC·LAVALIN

ATKINS

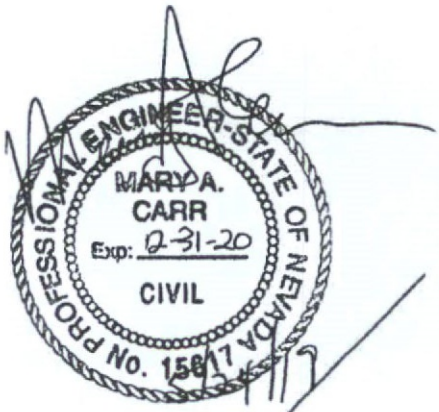
Member of the SNC-Lavalin Group

West Henderson Sewer Study

Bermuda Basin

City of Henderson

24 May 2019



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Introduction

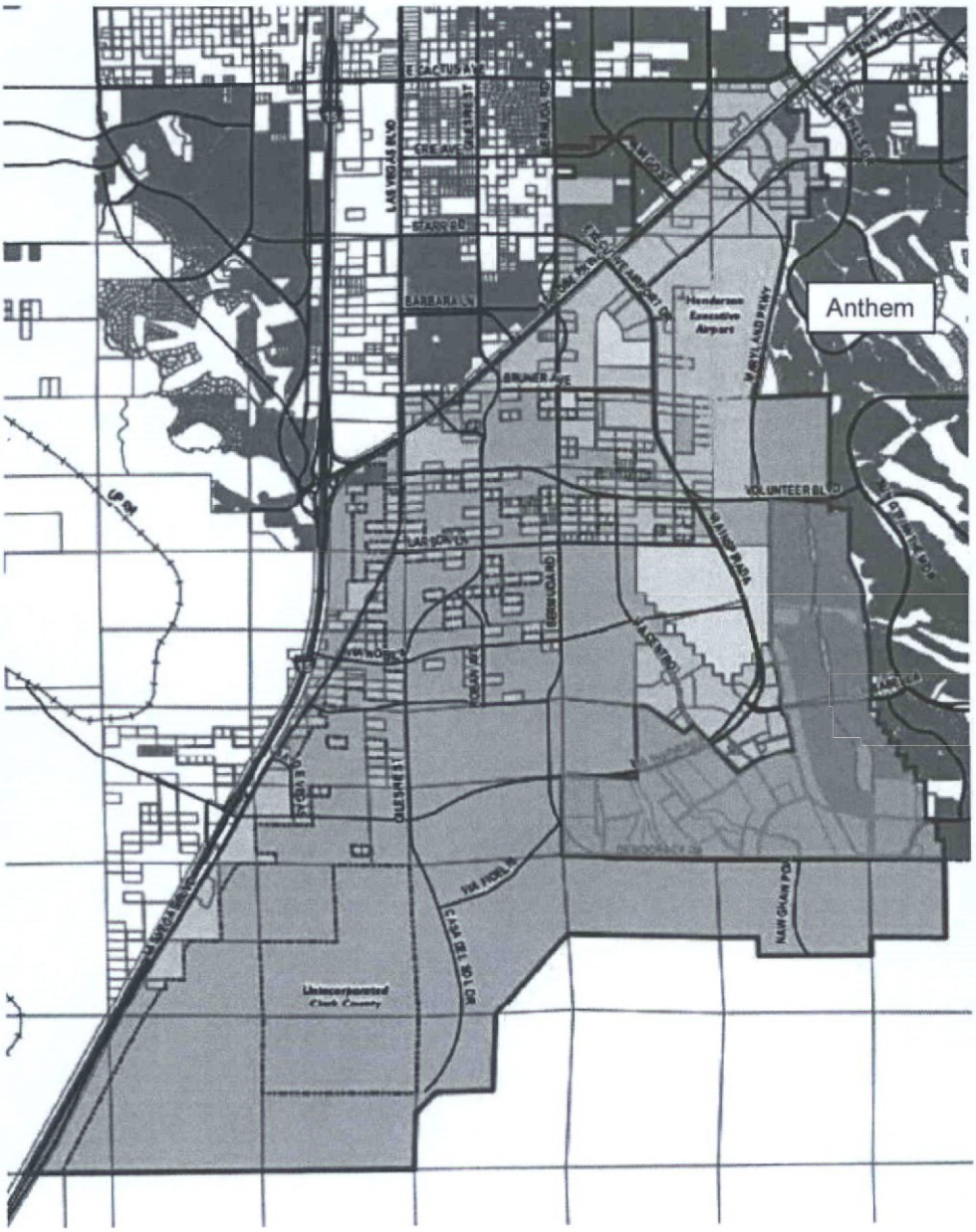
The West Henderson planning area consists of approximately 12,100 acres as identified in the City of Henderson's (City) 2017 Public Facility Needs Assessment. In order to determine the cost of the sewer backbone infrastructure to serve this area, the City needs to update the sewer master plan for the West Henderson planning area.

This report will provide the engineering basis for determining the size of the sewer infrastructure in the Bermuda Basin.

1. West Henderson Land Use

As stated above, the West Henderson planning area consists of approximately 12,100 acres. The area is located south of St. Rose Parkway, east of Interstate I-15 and west of the Anthem development as shown on Figure 1.

Figure 1 - West Henderson Planning Area



The West Henderson Land Use Plan was supplied by the City in the form of a GIS (geographic information system) map, which includes land use types shown in Table 1.

Table 1 - West Henderson Land Use Types

ID	Land Use Type
NT1	Neighborhood Type 1
NT2	Neighborhood Type 2
NT3	Neighborhood Type 3
NT4	Neighborhood Type 4
PC	Planned Community
PS	Public / Semi Public
NC	Neighborhood Commercial
COM	Commercial
HC	Highway Commercial
EC	Employment Center
TC	Tourist Commercial
UC	Urban Center
MU	Gateway Mixed Use
TOD	Transit Oriented Development
CO/RD	Office / Research & Development
LBI	Light Business / Industry
IND	Industrial
BI	Business / Industry

In the June 2017 West Henderson Land Use Plan Update, various Residential/Neighborhood Types were given densities or ranges of density. The following Land Use Types for residential were present in the areas for the Bermuda Basin:

Neighborhood Type 1: 4 units per gross acre
Neighborhood Type 2: 2 to 8 units per gross acre
Neighborhood Type 3: 8 to 16 units per gross acre
Neighborhood Type 4: 16 to 36 units per gross acre

Assumed densities used for the sewer analysis are presented in Table 2.

Table 2 - Residential Densities

Type of Development	Units per Gross Acre
Neighborhood Type 1	4
Neighborhood Type 2	6
Neighborhood Type 3	12
Neighborhood Type 4	26

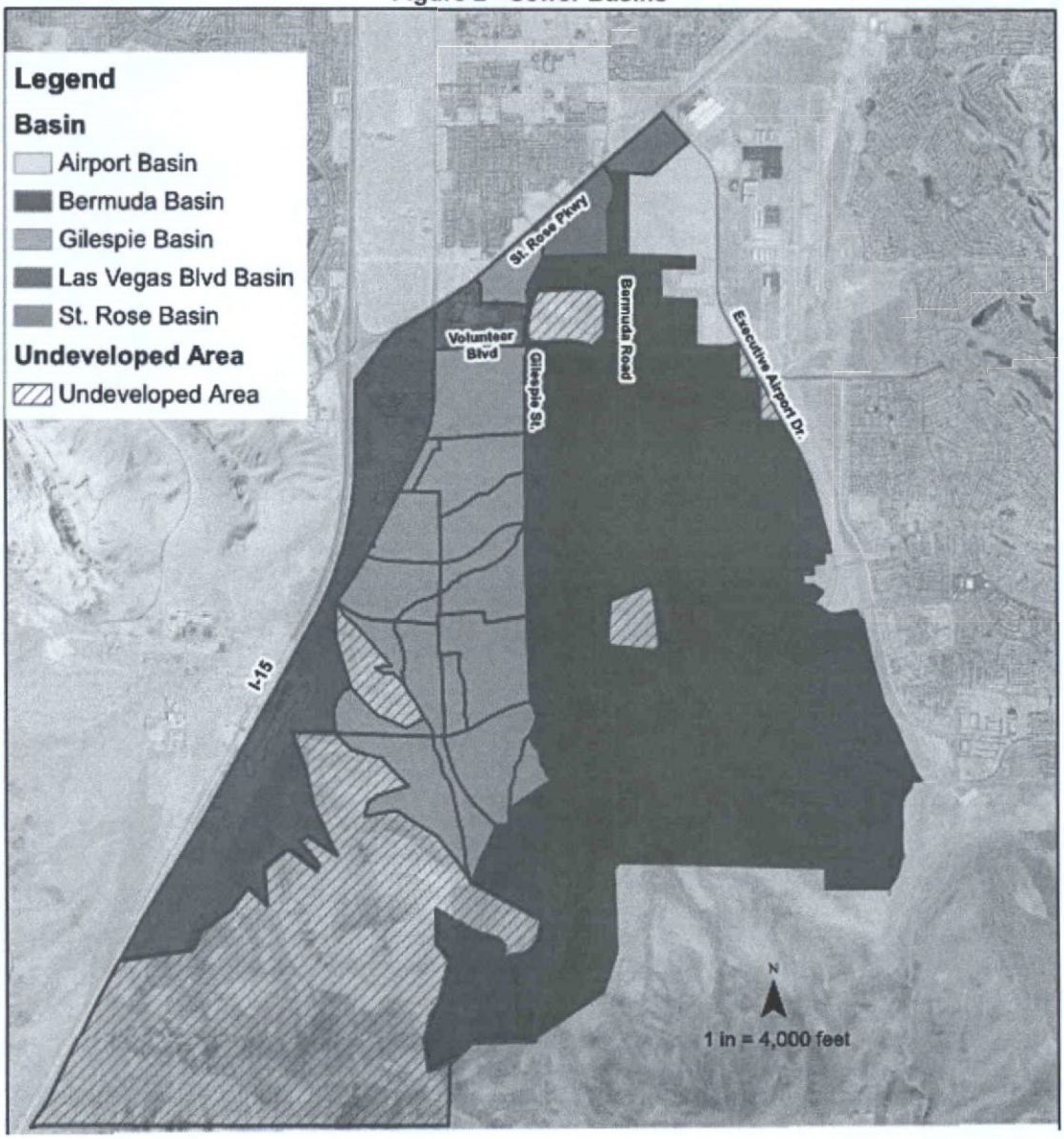
Major sewer basins in West Henderson, which are named according to the street name of the corresponding sewer alignment, include the Bermuda Basin, Gilespie Basin, St. Rose Basin, Las Vegas Boulevard Basin and Executive Airport Basin. Areas are shown on Figure 2.

Table 3 provides an estimate of the tributary acreage for each of the major sewer basins related to West Henderson.

Table 3 - Basin Areas

Basin	Area (Acres)
Bermuda	4,135
Gilespie	1,490
St. Rose	155
Las Vegas Blvd.	860
Executive Airport	250

Figure 2 - Sewer Basins



2. Constraints

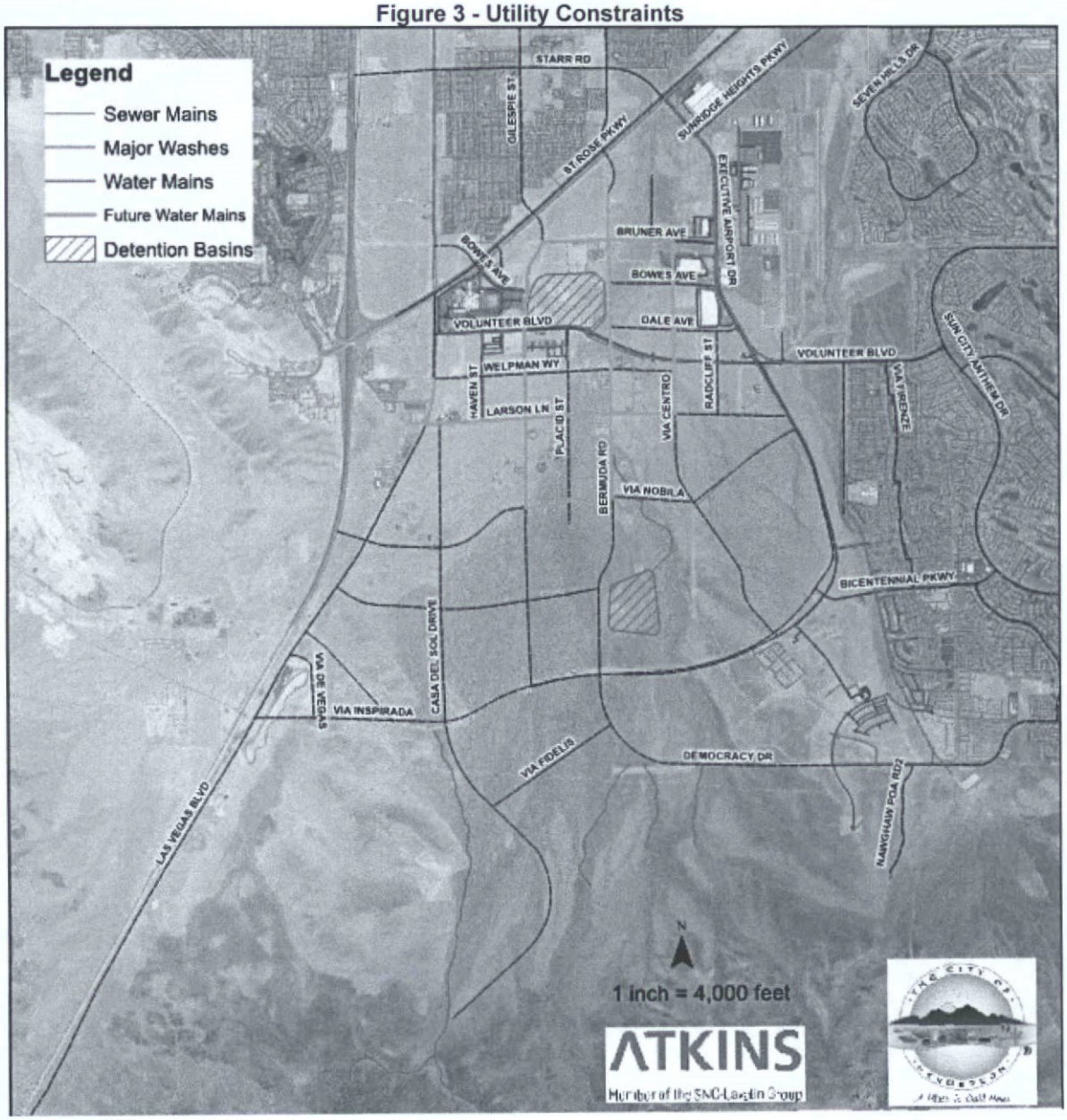
Utility constraints for the proposed Bermuda Sewer include facilities for storm drainage and water distribution, as shown on Figure 3.

In the study area there are numerous existing washes that will affect the depth of proposed sewer infrastructure. There are also existing and future detention basins that will affect future alignments. The Pittman North Detention Basin Outfall Channel is under construction on the west side of the proposed Bermuda Sewer just north of Bowes Avenue. Parcels west of Bermuda Road adjacent to the outfall channel are unable to access the Bermuda Sewer because it is on the other side of the outfall channel. A parallel sewer, which will cross the outfall channel further north, is required to serve these parcels.

A future detention basin, the North Bermuda Detention Basin, is located northeast of the intersection of Bermuda Road and Via Inspirada.

There are existing water lines and sewer lines in Volunteer Boulevard. Future pipelines are also being planned for this area.

Figure 3 - Utility Constraints



3. Wastewater Flow Projections

Wastewater flow projections are developed by applying standard wastewater contribution rates for average daily flow to the planning units from Chapter 1.

Peak flows were calculated using the ASCE (American Society of Civil Engineers) peaking factor. The following are criteria used in developing the wastewater flow projections:

- Average Flow = 250 gpd/ERU for residential or per Table 4 - Wastewater Contribution Rates for non-residential
- Peaking Factor = [(Average Flow in million gallons per day (MGD)) $^{-0.0956}$] 2.6186

- Peak Dry Weather Flow = [(Average Flow in MGD) $^{0.9044}$] 2.6186
- Peak Wet Weather Flow = Peak Dry Weather Flow * 1.25
- Maximum depth/Diameter (d/D) = 0.75 with peak wet weather flow.
- Manning's n value = 0.013
- Downstream pipes sizes are equal to or greater diameter

Table 4 - Wastewater Contribution Rates

Code	Description	ERU Equivalent Residential Unit (ERU/unit)	Sewer Contribution Rate	Unit
DRL	Downtown Low Density Residential	1.0	0	gal/day/ERU
DRM	Downtown medium density residential	1.0	0	gal/day/ERU
DR	Downtown high density residential	0.7	0	gal/day/ERU
DHC	Downtown highway commercial		2,000	gal/day/acre
DCC	Downtown core commercial		2,000	gal/day/acre
DP	Downtown public/semi-public		2,000	gal/day/acre
RNP-1	Rural neighborhood preservation 1 du/ac	1.0	0	gal/day/ERU
RNP-2	Rural neighborhood preservation 2 du/ac	1.0	0	gal/day/ERU
VLDR	Very low density residential	1.0	0	gal/day/ERU
LDR	Low density residential	1.0	0	gal/day/ERU
MDR	Medium density residential	0.7	0	gal/day/ERU
HDR	High density residential	0.7	0	gal/day/ERU
NT1	Neighborhood type 1	1.0	0	gal/day/ERU
NT2	Neighborhood type 2	1.0	0	gal/day/ERU
NT3	Neighborhood type 3	1.0	0	gal/day/ERU
NT4	Neighborhood type 4	0.7	0	gal/day/ERU
PC	Planned community	1.0	0	gal/day/ERU
PS	Public/semi public		2,000	gal/day/acre
NC	Neighborhood commercial		2,000	gal/day/acre
COM	Commercial		2,000	gal/day/acre
HC	Highway commercial		2,000	gal/day/acre
EC	Employment center		2,000	gal/day/acre
TC	Tourist commercial		2,000	gal/day/acre

UC	Urban center		4,000	gal/day/acre
MU	Gateway mixed use		3,000	gal/day/acre
TOD	Transit oriented development		2,000	gal/day/acre
CO/RD	Office/research & development		2,000	gal/day/acre
LBI	Light business/industry		2,000	gal/day/acre
IND	Industrial		3,000	gal/day/acre
BI	Business/industry		2,000	gal/day/acre

The major sewer basins are further divided into sub-basins as shown on Figure 4. Bermuda Basin sub-basins have a B prefix such as B1, B2, etc. and Gilespie Basin sub-basins have a G prefix, etc. The sewer pipe is divided in nine segments as follows:

Segment 1 – Bermuda Road from St. Rose Parkway to Bruner Avenue – 2,660 feet

Segment 2 – Bermuda Road from Bruner Avenue to Volunteer Boulevard – 3,175 feet

Segment 3 – Bermuda Road from Volunteer Boulevard to Larson Lane – 2,170 feet

Segment 4 – Bermuda Road from Larson Lane to Via Nobila – 2,590 feet

Segment 5 – Bermuda Road from Via Nobila and to the south 2,900 feet – 2,900 feet

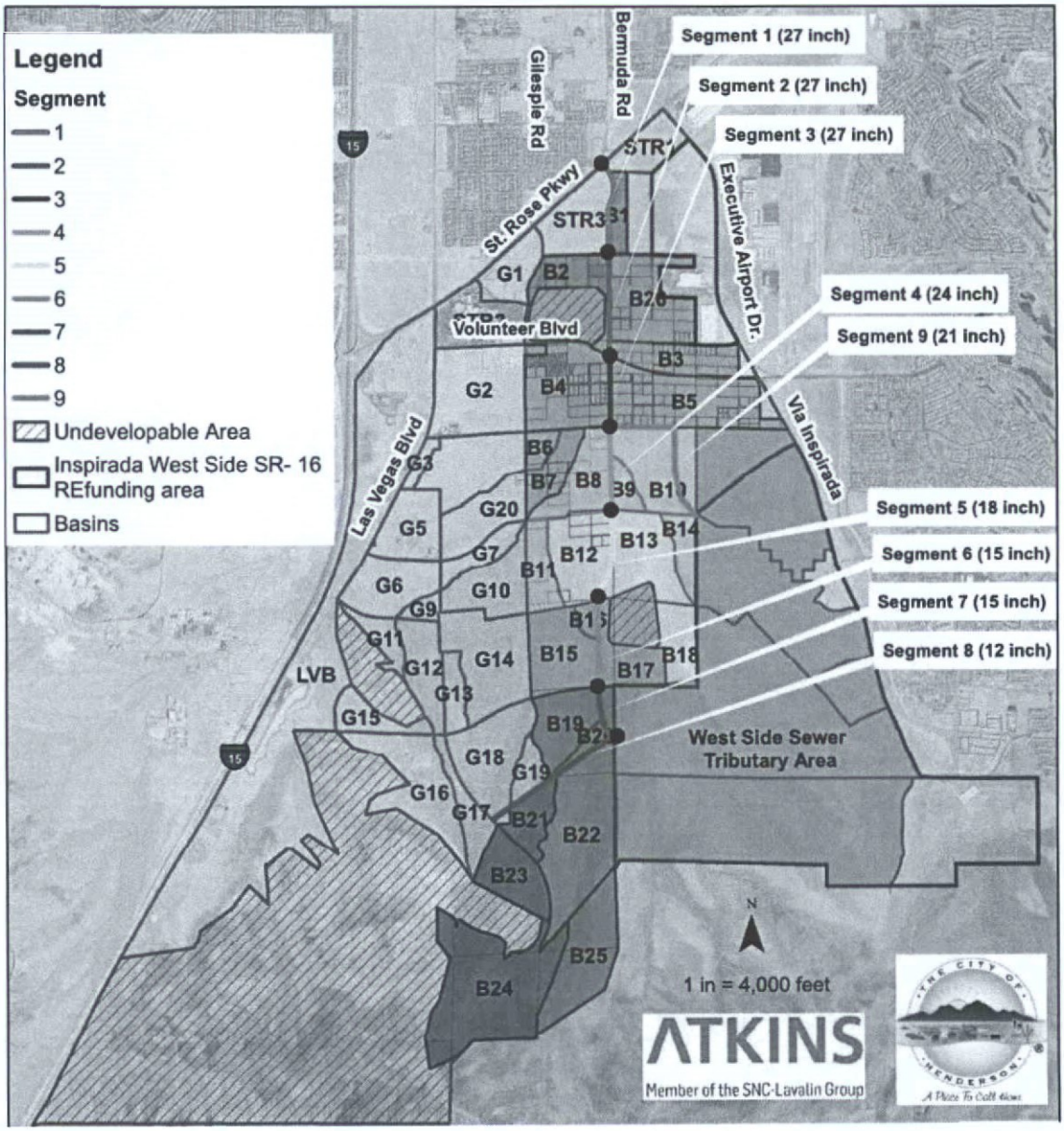
Segment 6 – Bermuda Road from 2,900 feet south of Via Nobila to Via Inspirada – 2,660 feet

Segment 7 – Bermuda Road from Via Inspirada to Via Fidelis – 1,610 feet

Segment 8 – Via Fidelis from Gilespie Road to Bermuda Road – 2,400 feet

Segment 9 – Larson Lane and Via Centro – 5,250 feet

Figure 4 - Bermuda Sewer Segments and Tributary Sub-basins



Wastewater flow projections, and the allocation of such, are shown in Table 5.

Table 5 - Wastewater Flow Projections

BASIN/ PARCEL	CATEGORY	DENSITY	LANDUSE	AREA (acres)	UNITS	AVE. FLOW (GPD)	TOTAL IN BASIN (GPD)	ERU IN SUBBASIN
B1							155293.5269	621.17
1	MDR	12	NT3	0.00	0.00	0.16		
2	HDR	26	NT4	0.62	16.15	2825.38		
3	HDR	26	NT4	3.52	91.52	16015.42		
	BI	0	BI	0.00		3.35		
4	COM	0	UC	19.34		76960.00		
5	BI	0	EC	29.74		59489.22		
B2							125959.07	503.84
1	HDR	26	NT4	4.18	108.68	19019.00		
2	MDR	12	NT3	2.41	28.92	7230.00		
3	MDR	12	NT3	2.95	35.40	8850.00		
4	BI	0	BI	0.00		0.01		
5	BI	0	BI	0.00		0.05		
6	MDR	12	NT3	4.35	52.20	13050.00		
7	COM	0	NC	1.82		3640.00		
8	COM	0	NC	0.00		0.00		
9	PS	0	PS	28.88		57760.00		
10	MDR	12	NT3	5.47	65.64	16410.00		
B3							227722.8754	910.89
1	BI	0	BI	0.04		80.74		
2	BI	0	BI	0.39		770.19		
3	HDR	26	NT4	14.30	371.72	65050.19		
4	COM	0	COM	8.96		17918.69		
5	MDR	12	NT3	16.21	194.53	48632.11		
6	PS	0	PS	14.21		28429.01		
7	BI	0	EC	33.42		66841.95		
B4							241698.4834	966.79
1	MDR	12	NT3		0.00	0.00		
2	MDR	12	NT3		0.00	0.00		
3	COM	0	UC	0.01		28.96		
4	PS	0	PS	2.24		4484.84		
5	COM	0	COM	5.87		11738.21		
6	MDR	12	NT3		0.00	0.00		
7	LDR	6	NT2	99.14	594.83	148706.93		
8	PS	0	PS	15.24		30481.24		
9	PS	0	PS	23.13		46258.29		
B5							426309.2978	1705.24
1	PS	0	PS	0.75		1495.74		
2	PS	0	PS	1.13		2264.40		
3	MDR	12	NT3	0.12	1.42	354.59		
4	HDR	26	NT4	19.11	496.76	86932.46		
5	LDR	6	NT2	39.46	236.74	59184.01		
6	MDR	12	NT3	28.60	343.15	85788.44		
7	COM	0	COM	10.38		20760.47		
8	PS	0	PS	8.10		16209.38		
9	BI	0	EC	76.66		153319.84		
B6							39561.48175	158.25
1	MDR	12	NT3	4.84	58.07	14516.68		
2	LDR	6	NT2	13.58	81.46	20365.44		
3	COM	0	COM	2.34		4679.36		
B7							78392.52924	313.57
1	MDR	12	NT3	1.79	21.48	5369.51		
2	LDR	6	NT2	35.61	213.68	53420.51		
3	PS	0	PS	5.37		10735.03		
4	PS	0	PS	1.73		3464.63		
5	COM	0	COM	2.55		5090.32		
6	COM	0	NC	0.16		312.51		
B8							188005.5328	752.02
1	LDR	6	NT2	20.77	124.63	31157.77		
2	LDR	6	NT2	1.13	6.78	1695.83		
3	PS	0	PS	44.79		89578.93		
4	PS	0	PS	4.00		8009.33		
5	MDR	12	NT3	0.11	1.37	343.67		
6	COM	0	NC	4.85		9692.83		
7	MDR	12	NT3	2.34	28.13	7033.29		
8	MDR	12	NT3	11.48	137.76	34440.25		
9	COM	0	NC	3.03		6053.63		
B9							60671.84209	242.69
1	MDR	12	NT3	0.11	1.33	331.83		
2	PS	0	PS	27.68		55368.20		
3	MDR	12	NT3	1.66	19.89	4971.82		

Table 5 – Wastewater Flow Projections Continued

BASIN/ PARCEL	CATEGORY	DENSITY	LANDUSE	AREA (acres)	UNITS	AVE. FLOW (GPD)	TOTAL IN BASIN (GPD)	ERU IN SUBBASIN
B10							281580.6011	1126.32
1	BI	0	BI	13.74		27485.49		
2	COM	0	UC	0.10		409.37		
3	PS	0	PS	0.00		5.57		
4	PS	0	PS	0.04		88.38		
5	HDR	26	NT4	1.41	36.55	6395.81		
6	BI	0	BI			0.00		
7	MDR	12	NT3	0.68	8.18	2044.69		
8	PS	0	PS	115.06		230110.34		
9	MDR	12	NT3	4.98	59.71	14926.62		
10	BI	0	EC	0.06		114.33		
B11							96663.44208	386.65
1	COM	0	COM	5.73		11467.69		
2	LDR	6	NT2	43.83	262.96	65741.17		
3	PS	0	PS	5.28		10566.82		
4	COM	0	NC	4.44		8887.77		
B12							170991.1469	683.96
1	COM	0	COM	2.45		4903.85		
2	LDR	6	NT2	80.34	482.04	120510.50		
3	PS	0	PS	15.40		30800.47		
4	PS	0	PS	0.82		1647.50		
5	PS	0	PS	6.56		13128.83		
B13							246451.1125	985.80
1	COM	0	COM	0.26		516.65		
2	MDR	0	NT3	0.00	0.04	11.12		
3	LDR	6	NT2	6.74	40.42	10104.53		
4	MDR	12	NT3	7.77	93.18	23295.52		
5	PS	0	PS	103.16		206321.07		
6	HDR	26	NT4	1.36	35.44	6202.22		
B14							126840.6318	507.36
1	HDR	26	NT4	5.45	141.61	24782.22		
2	COM	0	NC	3.83		7653.89		
3	MDR	12	NT3	16.27	195.27	48817.36		
4	PS	0	PS	2.10		4191.60		
5	HDR	26	NT4	9.10	236.55	41395.55		
B15							221043.3093	884.17
1	COM	0	COM	106.38		212769.94		
2	COM	0	COM	2.22		4430.33		
3	COM	0	NC	0.49		989.30		
4	PS	0	PS	0.02		49.97		
5	LDR	6	NT2	1.68	10.10	2524.99		
6	LDR	6	NT2	0.19	1.12	278.78		
B16							34973.52468	139.89
1	COM	0	COM	17.49		34973.52		
B17							136130.4312	544.52
1	COM	0	COM	67.30		134609.41		
2	PS	0	PS	0.44		875.06		
3	MDR	8	PC	0.30	2.43	607.34		
4	LDR	6	NT2	0.03	0.15	38.61		
B18							118250.9008	473.00
1	COM	0	COM	58.30		116594.57		
2	MDR	0	NT3	0.03	0.31	76.37		
3	MDR	8	PC	0.12	0.97	243.70		
4	MDR	12	NT3	0.02	0.30	74.26		
5	PS	0	PS	0.36		722.88		
6	HDR	26	NT4	0.12	3.08	539.13		
B19							132651.6229	530.61
1	COM	0	COM	0.14		279.94		
2	COM	0	NC	1.62		3233.23		
3	PS	0	PS	20.31		40621.53		
4	PS	0	PS	14.22		28441.01		
5	LDR	6	NT2	9.12	54.73	13681.88		
6	LDR	6	NT2	29.65	177.93	44481.49		
7	LDR	6	NT2	0.58	3.46	866.10		
8	LDR	4	NT1	1.05	4.19	1046.46		
B20							49536.08275	198.14
1	PS	0	PS	22.45		44893.82		
2	LDR	6	NT2	0.02	0.11	27.03		
3	LDR	4	NT1	4.62	18.46	4615.23		
B21							97227.38749	388.91
1	PS	0	PS	42.71		85414.41		
2	LDR	4	NT1	11.76	47.03	11756.77		
3	LDR	4	NT1	0.06	0.22	56.20		

Table 5 – Wastewater Flow Projections Continued

BASIN/ PARCEL	CATEGORY	DENSITY	LANDUSE	AREA (acres)	UNITS	AVE. FLOW (GPD)	TOTAL IN BASIN (GPD)	ERU IN SUBBASIN
B22							297679.8472	1190.72
1	PS	0	PS	88.33		176663.32		
2	LDR	4	NT1	12.84	51.36	12839.49		
3	LDR	4	NT1	94.18	376.72	94179.56		
4	MDR	0	PC	0.05	0.37	92.12		
5	LDR	4	NT1	13.91	55.62	13905.35		
B23							140409.7714	561.64
1	PS	0	PS	61.14		122288.59		
2	LDR	4	NT1	2.51	10.03	2506.46		
3	LDR	4	NT1	5.79	23.17	5791.59		
4	LDR	4	NT1	9.82	39.29	9823.13		
B24							357864.5612	1431.46
1	PS	0	PS	0.99		1986.45		
2	LDR	4	NT1	1.27	5.08	1269.00		
3	PS	0	PS	104.86		209712.95		
4	LDR	4	NT1	101.82	407.28	101819.27		
5	LDR	4	NT1	7.22	28.88	7219.10		
6	LDR	4	NT1	35.00	140.01	35002.14		
7	PS	0	PS	0.43		855.65		
B25							625.9216019	2.50
1	PS	0	PS	0.14		281.08		
2	PS	0	PS	0.03		52.05		
3	LDR	4	NT1	0.29	1.17	292.79		
B26							276307.6005	1105.23
1	MDR	12	NT3	0.01	0.17	43.32		
2	BI	0	BI	14.89		29789.90		
3	BI	0	BI	52.09		104179.53		
4	MDR	12	NT3	0.00	0.02	3.89		
5	COM	0	COM	0.00		0.95		
6	BI	26	EC	0.00		5.87		
7	HDR	36	NT4	0.02	0.44	76.56		
8	MDR	12	NT3	0.02	0.21	52.61		
9	PS	0	PS	0.08		154.32		
10	BI	0	EC	9.97		19942.43		
11	BI	0	EC	0.01		16.12		
12	BI	0	EC	56.00		112000.15		
13	BI	0	EC	5.02		10041.93		
B27							184,922.62	739.69
1	BI	0	BI	92.46		184,922.62		
Inspirada							2,075,000.00	8,300.00
A			VTN SR-16	660.50	2954.00	738,500.00		
B			South Area-West	563.85	409.60	102,400.00		
C			South Area Central		216.00	54,000.00		
D			Noerth Area	197.81	984.00	246,000.00		
E			Pod 5-4	65.79	319.00	79,750.00		
F			Pod 6-2		340.00	85,000.00		
G			Town Center	293.66	3077.40	769,350.00		
						TOTAL		26,355.06
						GPD	6,588,765.15	
						MGD	6.59	
						Peaking Factor		2.187
						PEAK FLOW (MGD)		14.41
						PWW (MGD)		18.01

4. Sewer Analysis

The profile of a portion of the proposed sewer in Bermuda Road from approximately 600 feet south to 1,200 feet north Bruner Avenue will prevent certain parcels west of Bermuda Road from connecting into the pipeline because of a storm drain that is west of the sewer line. For various reasons, groups of parcels are excluded from the Bermuda Basin. The parcels shown below in Table 6 will require a parallel sewer to St. Rose and are not included in the calculation of ERUs for the Bermuda alignment.

Table 6 - Parcels Tributary to St. Rose Sewer

Parcel	Name	Acreage	Land Use
191-04-801-006	Western Henderson	3.81	UC
191-04-801-005	Western Henderson	4.37	UC
191-04-801-003	Western Henderson	4.37	UC
191-04-801-012	Western Henderson	50.43	UC
191-04-801-008	Western Henderson	4.37	UC
191-04-801-007	Western Henderson	4.19	UC
191-04-703-001	Western Henderson	0.97	UC
191-04-703-002	Western Henderson	1	UC
191-04-703-003	Western Henderson	1.04	UC
191-04-703-004	Western Henderson	0.77	UC

The parcels shown in Table 7 will require a parallel sewer line in Bermuda and will connect into the Bermuda Sewer in Basin 1 where the storm drain alignment allows for connection.

Table 7 - Parcels Tributary to Segment 1 via Parallel Sewer

Parcel	Name	Acreage	Land Use
191-09-501-005	Keith Evans -Lion habitat	4.37	NT3
191-09-501-002	Crystal Capital	1.9	NT3
191-09-501-003	Keith Evans -Lion habitat	1.76	NT3
191-09-601-005	USA Portion for LVVWD facility	28.88	PS
191-09-501-001	Paradise Oasis	5	NT3
191-09-501-008	D F & L M LLC	2.08	NT3
191-09-501-009	D F & L M LLC	2.08	NT3
191-09-501-007	E K M LLC	1.93	NT4
191-09-501-006	E K M LLC	2.07	NT4

The ERUs of parcels shown in Table 8 are existing developments that will flow into the Gilespie Sewer and are not included in the calculation of ERUs and flows for the Bermuda alignment. Parcels in Table 8 were originally in sub-basin B4.

Table 8 - Parcels Tributary to Gilespie Sewer

Parcel	Name	Acreage	Land Use
191-09-701-001	205 Volunteer LLC	4.3	COM
Various APN	Single Family Development	14.56	NT2

SewerCAD was used to model the flows projected for the Bermuda Sewer. The average flows were applied to selected manholes according to Table 9.

Table 9 - Wastewater Flow Allocation

Basin	Sub-basins in each Basin	Total in Sub-basin (gpd)	ERUs in Sub-basin	ERUs for Basin	Manhole
1	B1	155,294	621	1,125	6A
	B2	125,959	504		
2				2,016	12
	B26	1,105	1,105		
	B3	227,723	911		
3				3,144	21
	B4	241,698	967		
	B5	426,309	1,705		
	B6	39,561	158		
	B7	78,393	314		
4				3,015	26
	B8	188,006	752		
	B9	60,672	243		
	B10	281,581	1,126		
	B11	96,663	387		
	B14	126,841	507		
5				2,143	33
	B12	170,991	684		
	B13	246,451	986		
	B18	118,251	473		
6				1,569	36
	B15	221,043	884		

	B16	34,974	140		
	B17	136,130	545		
7				1,922	39
	B20	49,536	198		
	B22	297,680	1,191		
	B25	626	3		
	B19	132,652	531		
8				2,382	40
	B21	97,227	389		
	B23	140,410	562		
	B24	357,865	1,431		
9					
	B27	184,923	740	9,040	103
	Inspirada		8,300		
Grand Total				26,355	

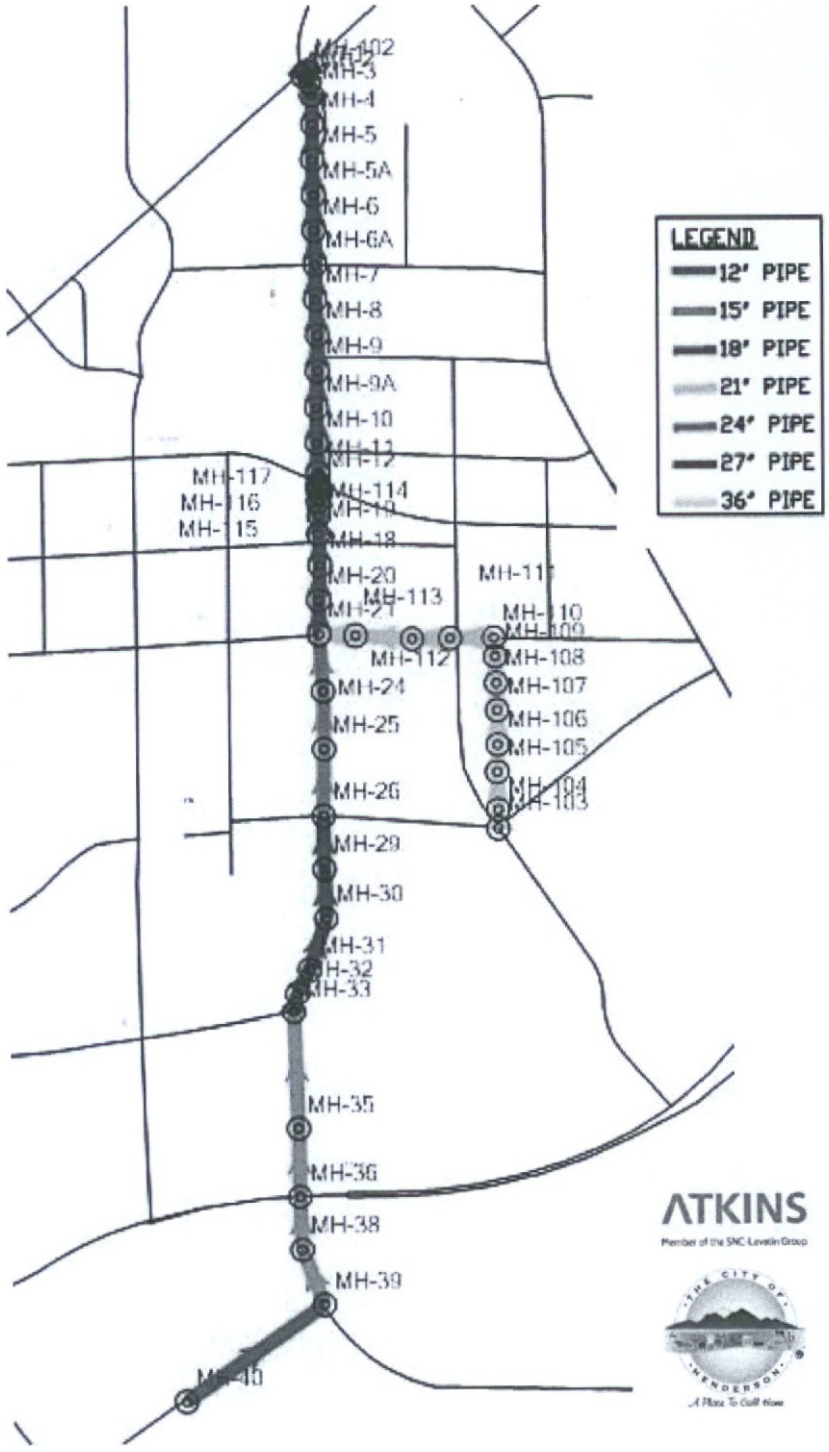
Table 10 shows the pipe diameters and ERUs for each segment of the Bermuda Sewer.

Table 10 - Bermuda Sewer Segments

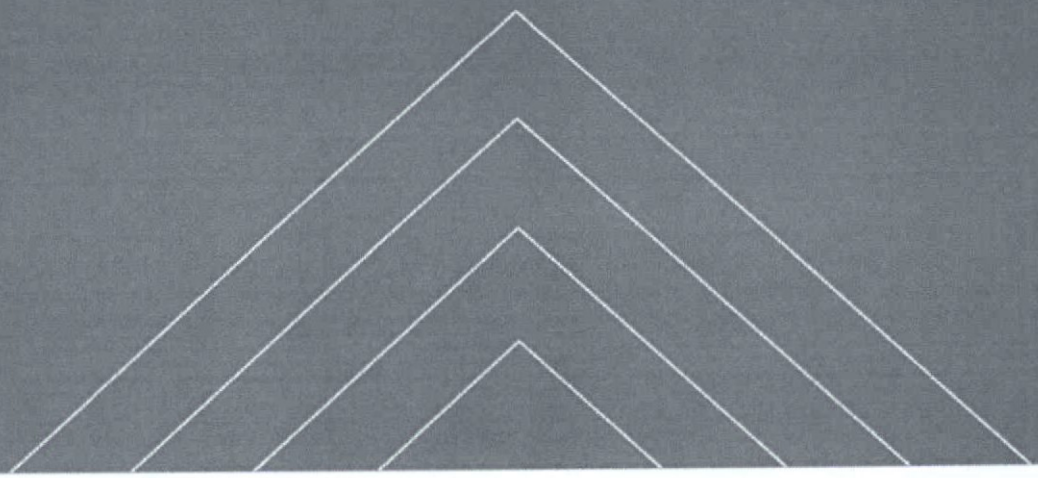
Segment	Description	Pipeline Length (ft)	Diameter (in)	Direct ERUs	Cumulative ERUs
1	St. Rose to Bruner	2,660	27	1,125	26,355
2	Bruner to Volunteer	3,175	27	2,016	25,230
3	Volunteer to Larson	2,170	27	3,144	23,214
4	Larson to Via Nobila	2,590	24	3,015	11,030
5	Via Nobila to south for 2900 FT	2,900	18	2,143	8,015
6	2900 South of Via Nobila to Via Inspirada	2,660	15	1,569	5,873
7	Via Inspirada to Via Fidelis	1,610	15	1,922	4,304
8	Via Fidelis- Bermuda to Gillespie	2,400	12	2,382	2,382
9	Larson Lane and Via Centro	5,250	21	9,040	9,040
	Totals	25,415		26,355	

Reports are attached showing the output tables for manholes, pipes, and outflow for average flow and peak wet weather flow. Pipe diameters for the Bermuda Sewer are shown in Figure 5.

Figure 5 - Bermuda Sewer Pipe Diameters



Appendix SewerCAD Data



West Henderson

FlexTable: Conduit Table

Active Scenario: Average Flow

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (MGD)	Velocity (ft/s)	d/D	Capacity (Design) (MGD)
P-39	MH-40	2,653.00	MH-39	2,618.00		2,398.7	0.0146	12.0	0.013	0.60	4.36	0.314	2.54
P-34	MH-35	2,568.00	MH-33	2,535.00		1,678.5	0.0197	15.0	0.013	1.47	6.14	0.341	5.34
P-35	MH-36	2,586.00	MH-35	2,568.00		980.3	0.0184	15.0	0.013	1.47	5.99	0.348	5.16
P-37	MH-38	2,600.00	MH-36	2,586.00		766.3	0.0183	15.0	0.013	1.08	5.48	0.296	5.15
P-38	MH-39	2,618.00	MH-38	2,600.00		841.7	0.0214	15.0	0.013	1.08	5.80	0.284	5.57
P-28	MH-26	2,484.00	MH-29	2,494.00		757.1	0.0132	18.0	0.013	2.00	5.72	0.346	7.12
P-29	MH-29	2,494.00	MH-30	2,509.00		707.7	0.0212	18.0	0.013	2.00	6.78	0.305	9.01
P-30	MH-30	2,509.00	MH-31	2,525.00		766.5	0.0209	18.0	0.013	2.00	6.75	0.307	8.95
P-31	MH-31	2,525.00	MH-32	2,530.00		379.4	0.0132	18.0	0.013	2.00	5.72	0.346	7.11
P-32	MH-33	2,535.00	MH-32	2,530.00		287.5	0.0174	18.0	0.013	2.00	6.31	0.322	8.16
P-109	MH-103	2,561.90	MH-104	2,559.23	190.7	261.7	0.0140	21.0	0.013	2.26	5.97	0.293	11.05
P-110	MH-104	2,559.23	MH-105	2,548.66	501.5	535.4	0.0211	21.0	0.013	2.26	6.91	0.263	13.56
P-111	MH-105	2,548.66	MH-106	2,538.06	494.0	388.0	0.0215	21.0	0.013	2.26	6.95	0.262	13.68
P-112	MH-106	2,538.06	MH-107	2,527.46	494.0	491.2	0.0215	21.0	0.013	2.26	6.95	0.262	13.68
P-113	MH-107	2,527.46	MH-108	2,516.86	494.0	389.8	0.0215	21.0	0.013	2.26	6.95	0.262	13.68
P-114	MH-108	2,516.86	MH-109	2,506.26	494.0	381.6	0.0215	21.0	0.013	2.26	6.95	0.262	13.68
P-115	MH-109	2,506.26	MH-110	2,495.99	426.8	268.3	0.0241	21.0	0.013	2.26	7.24	0.255	14.49
P-116	MH-110	2,495.99	MH-111	2,484.53	494.0	623.7	0.0232	21.0	0.013	2.26	7.14	0.257	14.22
P-117	MH-111	2,484.53	MH-112	2,477.61	494.0	542.9	0.0140	21.0	0.013	2.26	5.97	0.292	11.05
P-118	MH-112	2,477.61	MH-113	2,470.70	494.0	811.5	0.0140	21.0	0.013	2.26	5.96	0.293	11.04
P-119	MH-113	2,470.70	MH-21	2,464.38	451.6	524.8	0.0140	21.0	0.013	2.26	5.97	0.293	11.05
P-23	MH-21	2,464.38	MH-24	2,468.00		812.3	0.0045	24.0	0.013	2.76	4.13	0.364	8.90
P-24	MH-25	2,472.00	MH-24	2,468.00		826.9	0.0048	24.0	0.013	2.76	4.26	0.356	9.27
P-25	MH-26	2,484.00	MH-25	2,472.00		947.5	0.0127	24.0	0.013	2.76	6.02	0.277	15.00
P-2	MH-3	2,355.55	MH-2	2,351.61	262.6	186.6	0.0150	27.0	0.013	6.59	8.09	0.354	22.36
P-3	MH-4	2,363.25	MH-3	2,355.75	500.0	414.7	0.0150	27.0	0.013	6.59	8.09	0.354	22.35
P-4	MH-5	2,370.95	MH-4	2,363.45	500.0	508.1	0.0150	27.0	0.013	6.59	8.09	0.354	22.35
P-7	MH-8	2,403.61	MH-7	2,399.06	500.0	509.4	0.0091	27.0	0.013	6.31	6.67	0.396	17.41

West Henderson

FlexTable: Conduit Table

Active Scenario: Average Flow

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (MGD)	Velocity (ft/s)	d/D	Capacity (Design) (MGD)
P-8	MH-9	2,408.36	MH-8	2,403.81	499.8	512.0	0.0091	27.0	0.013	6.31	6.67	0.396	17.42
P-10	MH-11	2,421.90	MH-10	2,418.06	422.3	422.5	0.0091	27.0	0.013	6.31	6.67	0.396	17.41
P-11	MH-12	2,423.40	MH-11	2,422.10	142.9	138.7	0.0091	27.0	0.013	6.31	6.67	0.396	17.41
P-17	MH-18	2,449.98	MH-19	2,442.78	494.0	457.4	0.0146	27.0	0.013	5.80	7.73	0.334	22.03
P-18	MH-19	2,442.78	MH-114	2,428.63	373.2	262.9	0.0379	27.0	0.013	5.80	10.89	0.261	35.54
P-19	MH-20	2,457.18	MH-18	2,449.98	494.0	497.2	0.0146	27.0	0.013	5.80	7.73	0.334	22.03
P-20	MH-21	2,464.38	MH-20	2,457.18	494.0	483.6	0.0146	27.0	0.013	5.80	7.73	0.334	22.03
P-99	MH-10	2,417.86	MH-9A	2,413.31	499.9	502.4	0.0091	27.0	0.013	6.31	6.67	0.396	17.41
P-100	MH-9A	2,413.11	MH-9	2,408.56	500.1	526.0	0.0091	27.0	0.013	6.31	6.67	0.396	17.41
P-101	MH-5A	2,378.65	MH-5	2,371.15	500.0	506.0	0.0150	27.0	0.013	6.59	8.09	0.354	22.35
P-102	MH-6	2,386.35	MH-5A	2,378.85	500.0	496.5	0.0150	27.0	0.013	6.59	8.09	0.354	22.35
P-103	MH-6A	2,394.05	MH-6	2,386.55	500.0	489.6	0.0150	27.0	0.013	6.59	8.09	0.354	22.35
P-104	MH-7	2,398.86	MH-6A	2,394.25	500.0	502.6	0.0092	27.0	0.013	6.31	6.70	0.394	17.53
P-105	MH-2	2,351.41	MH-1	2,351.01	26.8	140.6	0.0149	27.0	0.013	6.59	8.07	0.355	22.29
P-107	MH-102	2,349.67	O-1	2,349.63	3.2	152.6	0.0140	27.0	0.013	6.59	7.89	0.361	21.60
P-108	MH-1	2,350.81	MH-102	2,349.75		86.0	0.0123	27.0	0.013	6.59	7.54	0.373	22.22
P-121	MH-115	2,426.33	MH-116	2,424.57	194.2	140.3	0.0091	27.0	0.013	5.80	6.51	0.379	17.38
P-122	MH-114	2,428.63	MH-115	2,426.33	65.9	189.1	0.0349	27.0	0.013	5.80	10.57	0.266	34.10
P-123	MH-116	2,424.57	MH-117	2,423.96	12.9	84.2	0.0473	27.0	0.013	5.80	11.77	0.247	39.69
P-124	MH-117	2,423.96	MH-12	2,423.40	33.9	48.9	0.0165	27.0	0.013	5.80	8.09	0.323	23.46

West Henderson

FlexTable: Manhole Table

Active Scenario: Average Flow

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (MGD)	Flow (Total Out) (MGD)
817	MH-1	2,374.30	2,350.81	6.59	6.59
818	MH-2	2,374.30	2,351.41	6.59	6.59
820	MH-3	2,376.83	2,355.55	6.59	6.59
822	MH-4	2,384.06	2,363.25	6.59	6.59
824	MH-5	2,389.41	2,370.95	6.59	6.59
826	MH-6	2,402.63	2,386.35	6.59	6.59
828	MH-7	2,412.96	2,398.86	6.31	6.31
830	MH-8	2,416.30	2,403.61	6.31	6.31
832	MH-9	2,422.97	2,408.36	6.31	6.31
834	MH-10	2,436.19	2,417.86	6.31	6.31
836	MH-11	2,441.50	2,421.90	6.31	6.31
838	MH-12	2,444.58	2,423.40	5.80	6.31
849	MH-18	2,459.68	2,449.98	5.80	5.80
851	MH-19	2,452.70	2,442.78	5.80	5.80
854	MH-20	2,468.93	2,457.18	5.80	5.80
856	MH-21	2,478.37	2,464.38	5.02	5.80
862	MH-24	2,481.00	2,468.00	2.76	2.76
864	MH-25	2,488.00	2,472.00	2.76	2.76
866	MH-26	2,494.00	2,484.00	2.00	2.76
872	MH-29	2,513.00	2,494.00	2.00	2.00
874	MH-30	2,524.00	2,509.00	2.00	2.00
876	MH-31	2,540.00	2,525.00	2.00	2.00
878	MH-32	2,545.00	2,530.00	2.00	2.00
880	MH-33	2,550.00	2,535.00	1.47	2.00
884	MH-35	2,578.00	2,568.00	1.47	1.47
886	MH-36	2,598.00	2,586.00	1.08	1.47
890	MH-38	2,616.00	2,600.00	1.08	1.08
892	MH-39	2,634.00	2,618.00	0.60	1.08
894	MH-40	2,668.00	2,653.00	0.00	0.60
1007	MH-9A	2,429.74	2,413.11	6.31	6.31
1010	MH-5A	2,396.55	2,378.65	6.59	6.59
1013	MH-6A	2,408.15	2,394.05	6.31	6.59
1021	MH-102	2,371.05	2,349.67	6.59	6.59
1031	MH-103	2,569.31	2,561.90	0.00	2.26
1032	MH-104	2,568.36	2,559.23	2.26	2.26
1034	MH-105	2,558.08	2,548.66	2.26	2.26
1036	MH-106	2,546.56	2,538.06	2.26	2.26
1038	MH-107	2,535.32	2,527.46	2.26	2.26
1040	MH-108	2,525.43	2,516.86	2.26	2.26
1042	MH-109	2,515.41	2,506.26	2.26	2.26
1044	MH-110	2,504.74	2,495.99	2.26	2.26
1048	MH-111	2,496.46	2,484.53	2.26	2.26
1049	MH-112	2,492.85	2,477.61	2.26	2.26
1050	MH-113	2,487.58	2,470.70	2.26	2.26
1051	MH-114	2,447.79	2,428.63	5.80	5.80

West Henderson

FlexTable: Manhole Table

Active Scenario: Average Flow

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (MGD)	Flow (Total Out) (MGD)
1052	MH-115	2,447.24	2,426.33	5.80	5.80
1054	MH-116	2,444.03	2,424.57	5.80	5.80
1056	MH-117	2,444.09	2,423.96	5.80	5.80

West Henderson

FlexTable: Outfall Table

Active Scenario: Average Flow

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (MGD)
896	O-1	2,371.05	2,349.63	2,350.62	6.59

West Henderson

FlexTable: Conduit Table

Active Scenario: Peak Flow (Wet Weather)

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (MGD)	Velocity (ft/s)	d/D	Capacity (Design) (MGD)
P-39	MH-40	2,653.00	MH-39	2,618.00		2,398.7	0.0146	12.0	0.013	2.05	5.99	0.638	2.54
P-34	MH-35	2,568.00	MH-33	2,535.00		1,678.5	0.0197	15.0	0.013	4.63	8.18	0.671	5.34
P-35	MH-36	2,586.00	MH-35	2,568.00		980.3	0.0184	15.0	0.013	4.63	7.96	0.688	5.16
P-37	MH-38	2,600.00	MH-36	2,586.00		766.3	0.0183	15.0	0.013	3.50	7.49	0.570	5.15
P-38	MH-39	2,618.00	MH-38	2,600.00		841.7	0.0214	15.0	0.013	3.50	7.96	0.542	5.57
P-28	MH-26	2,484.00	MH-29	2,494.00		757.1	0.0132	18.0	0.013	6.13	7.57	0.668	7.12
P-29	MH-29	2,494.00	MH-30	2,509.00		707.7	0.0212	18.0	0.013	6.13	9.11	0.570	9.01
P-30	MH-30	2,509.00	MH-31	2,525.00		766.5	0.0209	18.0	0.013	6.13	9.06	0.573	8.95
P-31	MH-31	2,525.00	MH-32	2,530.00		379.4	0.0132	18.0	0.013	6.13	7.56	0.668	7.11
P-32	MH-33	2,535.00	MH-32	2,530.00		287.5	0.0174	18.0	0.013	6.13	8.44	0.608	8.16
P-109	MH-103	2,561.90	MH-104	2,559.23	190.7	261.7	0.0140	21.0	0.013	6.84	8.03	0.538	11.05
P-110	MH-104	2,559.23	MH-105	2,548.66	501.5	535.4	0.0211	21.0	0.013	6.84	9.37	0.476	13.56
P-111	MH-105	2,548.66	MH-106	2,538.06	494.0	388.0	0.0215	21.0	0.013	6.84	9.43	0.474	13.68
P-112	MH-106	2,538.06	MH-107	2,527.46	494.0	491.2	0.0215	21.0	0.013	6.84	9.43	0.474	13.68
P-113	MH-107	2,527.46	MH-108	2,516.86	494.0	389.8	0.0215	21.0	0.013	6.84	9.43	0.474	13.68
P-114	MH-108	2,516.86	MH-109	2,506.26	494.0	381.6	0.0215	21.0	0.013	6.84	9.43	0.474	13.68
P-115	MH-109	2,506.26	MH-110	2,495.99	426.8	268.3	0.0241	21.0	0.013	6.84	9.83	0.459	14.49
P-116	MH-110	2,495.99	MH-111	2,484.53	494.0	623.7	0.0232	21.0	0.013	6.84	9.71	0.463	14.22
P-117	MH-111	2,484.53	MH-112	2,477.61	494.0	542.9	0.0140	21.0	0.013	6.84	8.03	0.537	11.05
P-118	MH-112	2,477.61	MH-113	2,470.70	494.0	811.5	0.0140	21.0	0.013	6.84	8.03	0.538	11.04
P-119	MH-113	2,470.70	MH-21	2,464.38	451.6	524.8	0.0140	21.0	0.013	6.84	8.03	0.538	11.05
P-23	MH-21	2,464.38	MH-24	2,468.00		812.3	0.0045	24.0	0.013	8.19	5.38	0.701	8.90
P-24	MH-25	2,472.00	MH-24	2,468.00		826.9	0.0048	24.0	0.013	8.19	5.57	0.680	9.27
P-25	MH-26	2,484.00	MH-25	2,472.00		947.5	0.0127	24.0	0.013	8.19	8.09	0.499	15.00
P-2	MH-3	2,355.55	MH-2	2,351.61	262.6	186.6	0.0150	27.0	0.013	17.99	10.42	0.636	22.36
P-3	MH-4	2,363.25	MH-3	2,355.75	500.0	414.7	0.0150	27.0	0.013	17.99	10.42	0.636	22.35
P-4	MH-5	2,370.95	MH-4	2,363.45	500.0	508.1	0.0150	27.0	0.013	17.99	10.42	0.636	22.35
P-7	MH-8	2,403.61	MH-7	2,399.06	500.0	509.4	0.0091	27.0	0.013	17.29	8.42	0.746	17.41

West Henderson

FlexTable: Conduit Table

Active Scenario: Peak Flow (Wet Weather)

Label	Start Node	Invert (Start) (ft)	Stop Node	Invert (Stop) (ft)	Length (User Defined) (ft)	Length (Scaled) (ft)	Slope (Calculated) (ft/ft)	Diameter (in)	Manning's n	Flow (MGD)	Velocity (ft/s)	d/D	Capacity (Design) (MGD)
P-8	MH-9	2,408.36	MH-8	2,403.81	499.8	512.0	0.0091	27.0	0.013	17.29	8.42	0.746	17.42
P-10	MH-11	2,421.90	MH-10	2,418.06	422.3	422.5	0.0091	27.0	0.013	17.29	8.41	0.746	17.41
P-11	MH-12	2,423.40	MH-11	2,422.10	142.9	138.7	0.0091	27.0	0.013	17.29	8.42	0.746	17.41
P-17	MH-18	2,449.98	MH-19	2,442.78	494.0	457.4	0.0146	27.0	0.013	16.04	10.06	0.595	22.03
P-18	MH-19	2,442.78	MH-114	2,428.63	373.2	262.9	0.0379	27.0	0.013	16.04	14.43	0.447	35.54
P-19	MH-20	2,457.18	MH-18	2,449.98	494.0	497.2	0.0146	27.0	0.013	16.04	10.06	0.595	22.03
P-20	MH-21	2,464.38	MH-20	2,457.18	494.0	483.6	0.0146	27.0	0.013	16.04	10.06	0.595	22.03
P-99	MH-10	2,417.86	MH-9A	2,413.31	499.9	502.4	0.0091	27.0	0.013	17.29	8.42	0.746	17.41
P-100	MH-9A	2,413.11	MH-9	2,408.56	500.1	526.0	0.0091	27.0	0.013	17.29	8.41	0.746	17.41
P-101	MH-5A	2,378.65	MH-5	2,371.15	500.0	506.0	0.0150	27.0	0.013	17.99	10.42	0.636	22.35
P-102	MH-6	2,386.35	MH-5A	2,378.85	500.0	496.5	0.0150	27.0	0.013	17.99	10.42	0.636	22.35
P-103	MH-6A	2,394.05	MH-6	2,386.55	500.0	489.6	0.0150	27.0	0.013	17.99	10.42	0.636	22.35
P-104	MH-7	2,398.86	MH-6A	2,394.25	500.0	502.6	0.0092	27.0	0.013	17.29	8.46	0.742	17.53
P-105	MH-2	2,351.41	MH-1	2,351.01	26.8	140.6	0.0149	27.0	0.013	17.99	10.40	0.638	22.29
P-107	MH-102	2,349.67	O-1	2,349.63	3.2	152.6	0.0140	27.0	0.013	17.99	10.14	0.652	21.60
P-108	MH-1	2,350.81	MH-102	2,349.75		86.0	0.0123	27.0	0.013	17.99	9.63	0.683	22.22
P-121	MH-115	2,426.33	MH-116	2,424.57	194.2	140.3	0.0091	27.0	0.013	16.04	8.31	0.703	17.38
P-122	MH-114	2,428.63	MH-115	2,426.33	65.9	189.1	0.0349	27.0	0.013	16.04	13.99	0.458	34.10
P-123	MH-116	2,424.57	MH-117	2,423.96	12.9	84.2	0.0473	27.0	0.013	16.04	15.65	0.420	39.69
P-124	MH-117	2,423.96	MH-12	2,423.40	33.9	48.9	0.0165	27.0	0.013	16.04	10.56	0.572	23.46

West Henderson

FlexTable: Manhole Table

Active Scenario: Peak Flow (Wet Weather)

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (MGD)	Flow (Total Out) (MGD)
817	MH-1	2,374.30	2,350.81	17.99	17.99
818	MH-2	2,374.30	2,351.41	17.99	17.99
820	MH-3	2,376.83	2,355.55	17.99	17.99
822	MH-4	2,384.06	2,363.25	17.99	17.99
824	MH-5	2,389.41	2,370.95	17.99	17.99
826	MH-6	2,402.63	2,386.35	17.99	17.99
828	MH-7	2,412.96	2,398.86	17.29	17.29
830	MH-8	2,416.30	2,403.61	17.29	17.29
832	MH-9	2,422.97	2,408.36	17.29	17.29
834	MH-10	2,436.19	2,417.86	17.29	17.29
836	MH-11	2,441.50	2,421.90	17.29	17.29
838	MH-12	2,444.58	2,423.40	15.91	17.29
849	MH-18	2,459.68	2,449.98	16.04	16.04
851	MH-19	2,452.70	2,442.78	16.04	16.04
854	MH-20	2,468.93	2,457.18	16.04	16.04
856	MH-21	2,478.37	2,464.38	13.87	16.04
862	MH-24	2,481.00	2,468.00	8.19	8.19
864	MH-25	2,488.00	2,472.00	8.19	8.19
866	MH-26	2,494.00	2,484.00	5.95	8.19
872	MH-29	2,513.00	2,494.00	6.13	6.13
874	MH-30	2,524.00	2,509.00	6.13	6.13
876	MH-31	2,540.00	2,525.00	6.13	6.13
878	MH-32	2,545.00	2,530.00	6.13	6.13
880	MH-33	2,550.00	2,535.00	4.49	6.13
884	MH-35	2,578.00	2,568.00	4.63	4.63
886	MH-36	2,598.00	2,586.00	3.39	4.63
890	MH-38	2,616.00	2,600.00	3.50	3.50
892	MH-39	2,634.00	2,618.00	1.93	3.50
894	MH-40	2,668.00	2,653.00	0.00	2.05
1007	MH-9A	2,429.74	2,413.11	17.29	17.29
1010	MH-5A	2,396.55	2,378.65	17.99	17.99
1013	MH-6A	2,408.15	2,394.05	17.22	17.99
1021	MH-102	2,371.05	2,349.67	17.99	17.99
1031	MH-103	2,569.31	2,561.90	0.00	6.84
1032	MH-104	2,568.36	2,559.23	6.84	6.84
1034	MH-105	2,558.08	2,548.66	6.84	6.84
1036	MH-106	2,546.56	2,538.06	6.84	6.84
1038	MH-107	2,535.32	2,527.46	6.84	6.84
1040	MH-108	2,525.43	2,516.86	6.84	6.84
1042	MH-109	2,515.41	2,506.26	6.84	6.84
1044	MH-110	2,504.74	2,495.99	6.84	6.84
1048	MH-111	2,496.46	2,484.53	6.84	6.84
1049	MH-112	2,492.85	2,477.61	6.84	6.84
1050	MH-113	2,487.58	2,470.70	6.84	6.84
1051	MH-114	2,447.79	2,428.63	16.04	16.04

West Henderson

FlexTable: Manhole Table

Active Scenario: Peak Flow (Wet Weather)

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Flow (Total In) (MGD)	Flow (Total Out) (MGD)
1052	MH-115	2,447.24	2,426.33	16.04	16.04
1054	MH-116	2,444.03	2,424.57	16.04	16.04
1056	MH-117	2,444.09	2,423.96	16.04	16.04

West Henderson

FlexTable: Outfall Table

Active Scenario: Peak Flow (Wet Weather)

ID	Label	Elevation (Ground) (ft)	Elevation (Invert) (ft)	Hydraulic Grade (ft)	Flow (Total Out) (MGD)
896	O-1	2,371.60	2,349.63	2,351.35	17.99

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Exhibit C

Bermuda Basin Rate Studies

[Attached]

SNC·LAVALIN

ATKINS
Member of the SNC-Lavalin Group

West Henderson Phase 1 Wastewater Backbone Infrastructure Rate

Bermuda Sewer Phase 1 Analysis

City of Henderson

29 August 2019

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Appendix A – Detailed Cost Estimates

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Table 1 – Residential Densities
Table 2 – Available ERUs
Table 3 – Cost Apportionment

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Figure 1 – West Henderson Planning Area
Figure 2 – Bermuda Sewer Basin

1. Project Background

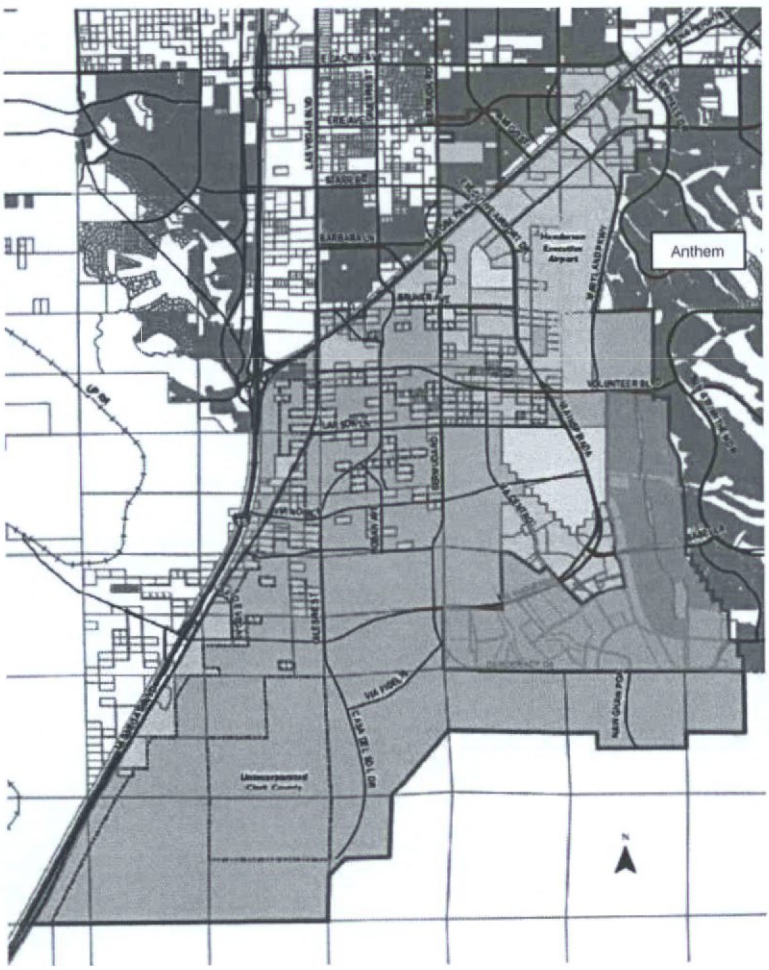
The purpose of this Report is to provide the engineering basis for determining the project cost and the cost for each Equivalent Residential Unit (ERU) for the proposed sanitary sewer in the Bermuda Road alignment between Volunteer Blvd and St Rose Pkwy.

The West Henderson planning area consists of approximately 12,100 acres as identified in the City of Henderson's (City) 2017 Public Facility Needs Assessment. To determine the cost of the sewer backbone infrastructure to serve a portion of this area, the City needs to update the sewer master plan for the West Henderson planning area.

2. Location

As stated above, the planning area consists of approximately 12,100 acres. The area is located south of St. Rose Parkway, east of Interstate I-15 and west of the Anthem development as shown on Figure 1 below.

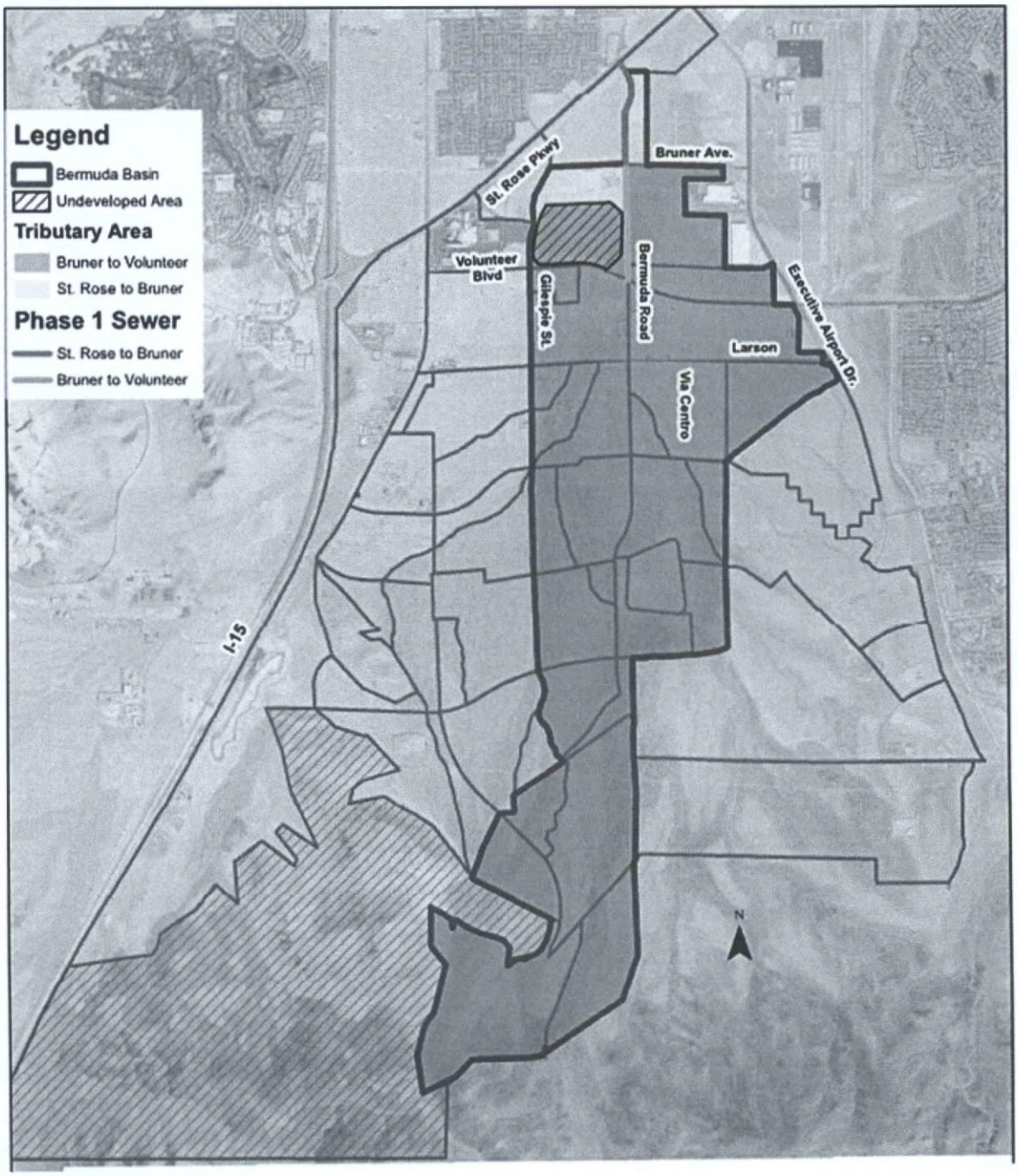
Figure 1 – West Henderson Planning Area



3. Bermuda Sewer Basin

The tributary area for the Bermuda Sewer, defined as the Bermuda Basin, is delineated on the west by Gilespie Road, St. Rose Parkway on the north and Executive Airport Drive on the east. The Bermuda Basin is approximately 4,135 gross acres as shown on Figure 2.

Figure 2 – Bermuda Sewer Basin



4. Wastewater Flow Projections

Wastewater flows projections are based on the West Henderson Land Use Plan and the following assumptions:

- 250 gpd (average daily flow) per ERU
- Wastewater peaking factor according to ASCE curve
- Wet weather allowance, an additional twenty five percent of dry weather peak hourly flow
- Maximum Depth/Diameter (d/D) = 0.75 with peak wet weather flow.
- Manning's n value = 0.013
- Downstream pipes sizes are equal to or greater diameter

5. Project Elements

Project elements of Bermuda Sewer Phase 1 (PCOH 08408) consist of pipelines and manholes between St. Rose Pkwy and Volunteer Blvd. The total length of proposed sewer pipe to be installed is 5,835 ft of 27" PVC. There are 18 sewer manholes total in this sewer line, all of which are 72" diameter apart from one 96" diameter manhole located where the Bermuda Sewer Phase 1 line meets St. Rose Parkway.

6. Land Acquisition

All construction for the Bermuda Sewer Phase 1 is to be done within public Right-of-Way. Therefore, no land acquisition costs were factored into this Rate Study.

7. Cost Apportionment

Table 2 presents the available flow capacity for the Bermuda Sewer Phase 1 as well as the pipe characteristics that affect capacity determination.

Table 2 – Available ERUs

Description	Limiting Slope	Diameter (in)	d/D	Pipeline Capacity (MGD)	Average Flow (MGD)	Available ERUs
St. Rose to Bruner	0.0141	27	0.75	21.67	8.08	32,338
Bruner to Volunteer	0.0091	27	0.75	17.41	6.35	25,386

Project costs include construction cost, according to the change order included as an appendix, and engineering cost. The project costs and the basis for apportionment are presented in Table 3.

Table 3 – Cost Apportionment

Description	Construction Cost	Engineering	Total Cost	Available ERUs	Cost Per ERU
St. Rose to Bruner	$934,100	$85,197	$1,019,297	32,338	$31.52
Bruner to Volunteer	$1,114,951	$101,693	$1,216,644	25,386	$47.93

The cost apportionment for the Bermuda Sewer Phase between St. Rose and Bruner is $31.52 per ERU.

The cost apportionment for the Bermuda Sewer Phase between Bruner and Volunteer is $47.93 per ERU.

Appendix A – Detailed Cost Estimates

CITY OF HENDERSON

CONTRACT CHANGE ORDER

CONTRACT NAME:	Pittman North Detention Basin and Outfall, Phase III	C.O. NUMBER:	CO-3
CONTRACT NO.:	19050 (PCOH 2017-88-3019)	DATE:	12/18/2018
CONTRACTOR:	Fisher Sand & Gravel Co.	***Funding Sources:***	
		~~*CCRFCD Direct Pay*~~	~~*HEN16F17*~~
		DUS Water	*5203-3620-701014-U0168*
CMTS: 19050		*DUS Sewer*	*5303-3720-701014-U0168*

SUBJECT:

Change Order No. 3 for construction of the Bermuda Sewer Phase 1 project.

CONTRACTOR:

You are hereby requested to comply with the following change from the contract plans and specifications. Execution of this change order represents full and final costs of all direct, indirect, and delay costs for the scope of services identified hereon unless noted otherwise. This document shall become an amendment to the contract and all provisions of the contract will apply hereto:

ITEM #	QTY or % INCREASE/ (DECREASE)	UNIT	UNIT PRICE	BID ITEM DESCRIPTION AND NECESSITY OF CHANGE	INCREASE/ (DECREASE) TO CONTRACT
ADDITIONAL WORK:					
1	1	LS	$ 25,000.00	Traffic Control	$ 25,000.00
2	100	CY	$ 57.00	R&R Type 2 Base Under Asphalt	$ 5,700.00
3	1	LS	$ 32,280.00	1" Mill and Place UTACS on Volunteer	$ 32,280.00
4	385	SF	$ 14.00	R&R 2-Inch AC on Trail	$ 5,390.00
5	600	SF	$ 50.00	R&R 6-Inch Asphalt	$ 30,000.00
6	1	LS	$ 5,400.00	R&R Median Island & Landscaping	$ 5,400.00
7	1	LS	$ 15,000.00	Remove 10" Sewer (193 LF) & Manholes (3 Each)	$ 15,000.00
8	1	LS	$ 10,500.00	Demo Existing Structrues in ROW	$ 10,500.00
9	210	LF	$ 225.00	Install 10" PVC Sewer Line	$ 47,250.00
10	5835	F	$ 200.00	Install 27" PVC Sewer	$ 1,167,000.00
11	17	EA	$ 28,000.00	Install 72" Sewer Manholes	$ 476,000.00
12	1	EA	$ 35,000.00	Install 96" Sewer Manhole	$ 35,000.00
13	1	EA	$ 15,000.00	Well Abandonment	$ 15,000.00
14	1	LS	$ 102,531.45	60 & 66 Inch Casings	$ 102,531.45
				ADDITIONAL WORK SUB-TOTAL:	**$ 1,972,051.45**
ADDITIONAL ALTERNATIVES:					
AddAlt 1	1	LS	$ 27,000.00	Bypass Sewer Line @ Volunteer	$ 27,000.00
AddAlt 2	1	LS	$ 50,000.00	Bypass Sewer Line @ St Rose Parkway	$ 50,000.00
				ALTERNATIVES SUB-TOTAL:	**$ 77,000.00**

		Total *This* Change Order	**$ 2,049,051.45**
COMPLETION DATE:	7/9/2019	**Total PREVIOUS Change Orders**	(529,645.96)
DAYS ADDED THIS CO:	0	***NET CHANGE TO CONTRACT***	1,519,405.49
Days Added–*PRIOR* COs/Conflicts:	0	**ORIGINAL CONTRACT TOTAL**	23,500,000.00
Adjusted COMPLETION DATE:	7/9/2019	***ADJUSTED CONTRACT TOTAL***	**$ 25,019,405.49**

Effect on Operation and Maintenance: NONE

Will this affect expiration or extent of insurance coverage?....NO If "YES" will policies be extended?

Contractor: *Fisher Sand & Gravel Co.*	Name/Title:	Robert Nelson, Sr. Project Manager	Date:
Quality Control:	Name/Title:	Lance Olson, P.E. Quality Control Manager	Date:
Utility Services:	Name/Title:	John Day, Deputy Dir-Util Eng/Asset Mgmt (or designee)	Date:
Engineering:	Name/Title:	Thomas Davy, P.E. City Engineer (or designee)	Date:
Public Works:	Name/Title:	Edward McGuire, P.E. Director of Public Works (or designee)	Date:

Council Approval Date: 2/6/2018 **Contract Funding:** Construction - $23,500,000.00 Contingency - $1,000,000.00

DISTRIBUTION-----------> Original: City Clerk's Office

Copies: **CONTRACTOR**, Project Engineer--Al Jankowiak, QC Inspector(s)--Derek Ritchie/Rick Gwartney, QC Sr Inspector--Ed Babine, QC--Lance Olson

Fisher Industries | 2950 Sunridge Heights Parkway | Henderson, NV | ph (702) 929-3157 | fax (725) 222-7960

FISHER SAND & GRAVEL (FSG) SCOPE OF WORK

27" Sewer Line Installation

Project: **Pittman North Detention Basin** Attn: Lance Olson Email: Lance.Olson@cityofhenderson.com

Date: 11/27/2018

Item #	Qty	Description	Unit	Price	TOTAL
1	1	Traffic Control	LS	$25,000.00	$ 25,000.00
2	100	R&R Type 2 Base Under Asphalt	CY	$57.00	$ 5,700.00
3	1	1" Mill and Place UTACS on Volunteer	LS	$32,280.00	$ 32,280.00
4	385	R&R 2-Inch AC on Trail	SF	$14.00	$ 5,390.00
5	600	R&R 6-Inch Asphalt	SF	$50.00	$ 30,000.00
6	1	R&R Median Island & Landscaping	LS	$5,400.00	$ 5,400.00
7	1	Remove 10" Sewer (193 LF) & Manholes (3 Each)	LS	$15,000.00	$ 15,000.00
8	1	Demo Existing Structrues in ROW	LS	$10,500.00	$ 10,500.00
9	210	Install 10" PVC Sewer Line	LF	$225.00	$ 47,250.00
10	5,835	Install 27" PVC Sewer	LF	$200.00	$ 1,167,000.00
11	17	Install 72" Sewer Manholes	EA	$28,000.00	$ 476,000.00
12	1	Install 96" Sewer Manhole	EA	$35,000.00	$ 35,000.00
13	1	Well Abandonment @ Bermuda Road	LS	$15,000.00	$ 15,000.00
Add Alt	1	Bypass Sewer Line @ Volunteer	LS	$27,000.00	$ 27,000.00
Add Alt	1	Bypass Sewer Line @ St Rose Parkway	LS	$50,000.00	$ 50,000.00
				SubTotal	
				TOTAL	$ 1,946,520.00

SPECIAL TERMS OR CONDITIONS:

Fisher Sand & Gravel

Robert Nelson — By

SR Project Manager — Title

NDOT 3580 - Boulder City Bypass
Contract Change Request Worksheet -

Original Date: 8/18/2017

Scope of Work: 60 & 66 Inch Casings

Material Cost

Description	Unit				Quantity	Material Unit Price	Material Subtotal
Core & Main	LS				1	$ 43,816.20	$ 43,816.20
CLSM	CY				121	$ 72.69	$ 8,796.00
					Material Cost Subtotal		$ 52,612.20
						Sales Tax (8.25%)	$ 4,340.51
						TOTAL MATERIAL	**$ 56,952.71**

Direct Labor (outside of Operated Equipment

Classification	Unit				Labor Unit Price	Hours	Labor Subtotal
Operators	Hrs				$ 71.90	104	$ 7,477.60
Truck Driver Group 6	Hrs				$ 55.41	39	$ 2,160.99
							$ -
							$ -
							$ -
						Direct Labor Subtotal	$ 9,638.59
					Labor Burden @ 35%		$ 3,373.51
						Labor Subtotal	**$ 13,012.10**

Subcontractor Cost

Subcontractor/Vendor				Quantity	Unit	Unit Price	Invoices
						Subcontractor Subtotal	**$ -**

Equipment Costs (Includes Fuel/Maintenance, No Operator)

Equipment	Rate	Hours Used/Stby	Equip Cost Standby	GPH	Delivery To Site	Delivery From Site	Total
Cat D9 Dozer	$187.88	32					$ 6,012.11
Volvo 700 Excavator	$240.60	33					$ 7,939.80
Cat CS56B Compactor	$53.10	8					$ 424.80
Cat 8000 Gallon Water Truck	$191.28	39					$ 7,459.81
Cat 825 Compactor	$167.35	4					$ 669.40
3/4 Ton Pickup	$15.41	48					$ 739.68
						Equipment Subtotal	**$ 23,245.60**

SUBTOTAL	$ 93,210.41
Overhead and Markup (10%)	$ 9,321.04
Total	$ 102,531.45
Grand Total	$ 102,531.45

	CAT CS56 B Compactor	Cat 8K Water Truck	Volvo 700 Excavator	Cat 825 Compactor	Cat D9 Dozer
MONTHLY	$4,752.00	$13,680.00	$22,000.00	$14,080.00	$13,865.00
HOURLY	$27.00	$77.73	$125.00	$80.00	$78.78
OPR COST	$26.10	$113.55	$115.60	$87.35	$109.10
TOTAL RATE	$53.10	$191.28	$240.60	$167.35	$187.88
	Cat 14H Blade	Volvo A60 Rock Truck	CAT 621 Water Pull	3/4 Ton Pickup	Klein Tank
MONTHLY	$9,695.00	$11,590.00	$7,720.00	$625.00	$1,360.00
HOURLY	$55.09	$65.85	$43.86	$3.55	$7.73
OPR COST	$57.00	$91.85	$52.80	$11.50	$7.10
TOTAL RATE	$112.09	$157.70	$96.66	$15.05	$14.83

SNC·LAVALIN

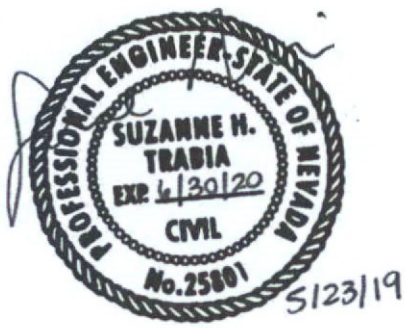
ATKINS
Member of the SNC-Lavalin Group

West Henderson Phase 2 Wastewater Backbone Infrastructure Rate

Bermuda Sewer Phase 2 Analysis

City of Henderson

May 23, 2019



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Appendix A – Detailed Cost Estimates

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Table 1 – Available ERUs
Table 2 – Cost Apportionment

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Figure 1 – West Henderson Planning Area
Figure 2 – Bermuda Sewer Phase 2 Tributary Area

1. Project Background

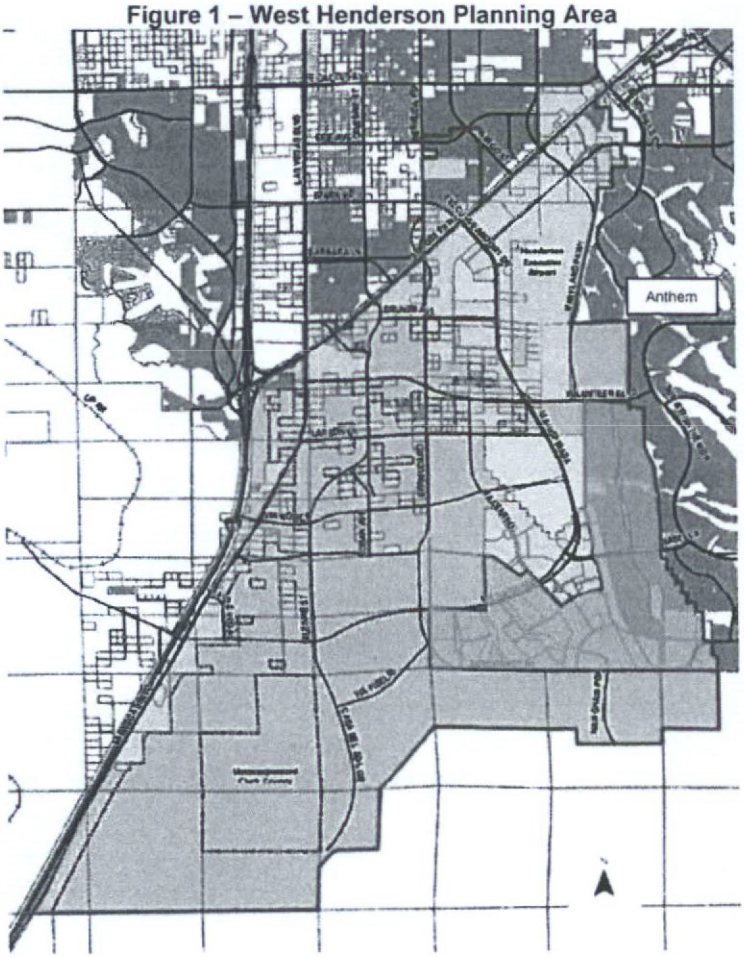
The purpose of this Report is to provide the engineering basis for determining the project cost and the cost for each Equivalent Residential Unit (ERU) for the proposed sanitary sewer in the Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road, and Via Centro from Via Nobila to Larson Lane.

The West Henderson planning area consists of approximately 12,100 acres as identified in the City of Henderson's (City) 2017 Public Facility Needs Assessment. To determine the cost of the sewer backbone infrastructure to serve a portion of this area, the City needs to update the sewer master plan for the West Henderson planning area.

2. Location

As stated above, the planning area consists of approximately 12,100 acres. The area is located south of St. Rose Parkway, east of Interstate I-15 and west of the Anthem development as shown on Figure 1 below.

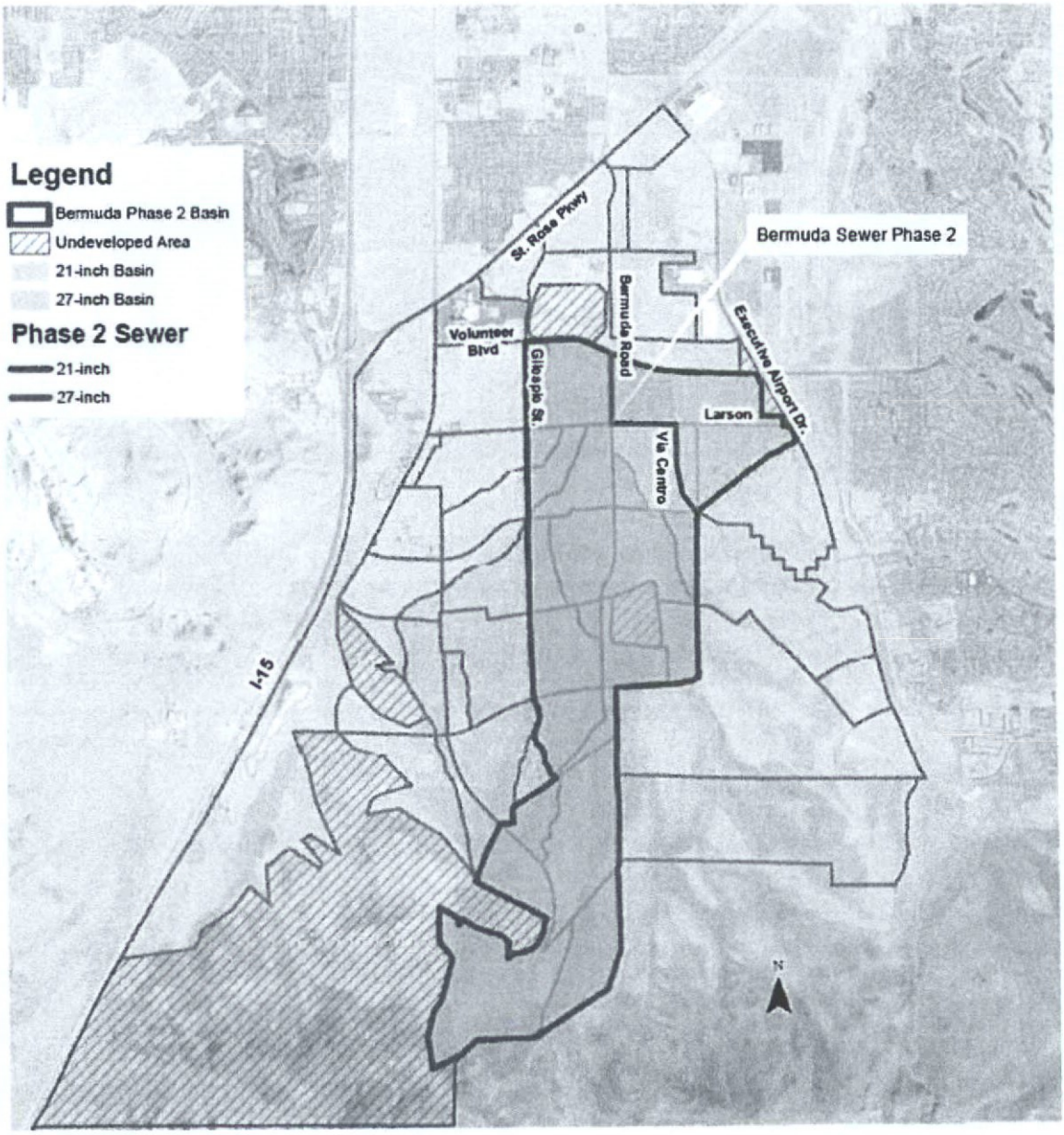
Figure 1 – West Henderson Planning Area



3. Bermuda Sewer Basin

The tributary area for the Bermuda Sewer, defined as the Bermuda Basin, is delineated on the west by Gilespie Road, St. Rose Parkway on the north and Executive Airport Drive on the east. The Bermuda Sewer Phase 2 is south of Volunteer Boulevard (Phase 1 is north) and has a tributary area of approximately 2,273 gross acres as shown on Figure 2.

Figure 2 – Bermuda Sewer Phase 2 Tributary Area



4. Wastewater Flow Projections

Wastewater flows projections are based on the West Henderson Land Use Plan and the following assumptions:

- 250 gpd (average daily flow) per ERU
- Wastewater peaking factor according to ASCE curve
- Wet weather allowance, an additional twenty five percent of dry weather peak daily flow
- Maximum Depth/Diameter (d/D) = 0.75 with peak wet weather flow.
- Manning's n value = 0.013
- Downstream pipes sizes are equal to or greater diameter

5. Project Elements

Project elements of Bermuda Sewer Phase 2 consist of pipelines and manholes in the Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road, and Via Centro from Via Nobila to Larson Lane. The total length of proposed sewer pipe to be installed is 2,155 feet of 27-inch PVC and 5,095 feet of 21-inch PVC. There are 18 sewer manholes total in this sewer line, all of which are 72" diameter.

6. Land Acquisition

The construction for the Bermuda Sewer Phase 2 to be done within public Right-of-Way includes Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road. There is right-of-way required on Via Centro from Via Nobila to Larson Lane.

7. Cost Apportionment

Table 1 presents the available flow capacity for the Bermuda Sewer Phase 2 as well as the pipe characteristics that affect capacity determination.

Table 1 – Available ERUs

Description	Limiting Slope	Diameter (in)	d/D	Pipeline Capacity (MGD)	Average Flow (MGD)	Available ERUs
Bermuda: Volunteer to Larson	0.0086	27	0.75	16.90	6.14	24,565
Bermuda/Larson to Via Centro/Via Nobila	0.0140	21	0.75	11.00	3.82	15,280

The projected project costs and the basis for apportionment are presented in Table 2.

Table 2 – Cost Apportionment

Description	Pipeline Length (ft)	Diameter (in)	Construction Cost	Engineering	Total Cost	Available ERUs	Cost Per ERU
Bermuda: Volunteer to Larson	2,155	27	$878,050	$131,708	$1,009,758	24,565	$41.11
Bermuda/Larson to Via Centro/Via Nobila	5,095	21	$1,731,130	$259,670	$1,990,800	15,280	$130.29

The cost apportionment for the Bermuda Sewer Phase 2 is $41.11 per ERU from Larson to Volunteer and $130.29 from Via Nobila to Larson.

Appendix A – Detailed Cost Estimates

Basin	Description	Pipeline Length (ft)[1]	Diameter (in)	Pipe Cost/lf	Pipeline Cost	No of Manholes[2]	Manhole Cost (ea)	Manhole Cost	Construction Cost	Engineering/ Design (15%)	Total Cost	Direct ERUs	Segment Cost per ERU
1	Bermuda: Volunteer to Larson	2,155	27	$310	$668,050	7	$30,000	$210,000	$878,050	$131,708	$1,009,758	24,565	$41.11
2	Bermuda/Larson to Via Centro/Via Nobila	5,095	21	$275	$1,401,130	11	$30,000	$330,000	$1,731,130	$259,670	$1,990,800	15,280	$130.29

[1] Rounded to the nearest tenth

[2] Manhole every 450 feet rounded up

Basin 1 - Pipe Unit Cost	
Jack and bore length (LF)	158
Jack and bore unit cost ($/LF)	$ 1,500.00
Jack and bore cost ($)	$237,000.00
27-inch length (LF)	2155
27-inch unit cost ($/LF)	$ 200.00
27-inch cost ($)	$431,000.00
Total cost of jack and bore + 27-inch ($)	$668,000.00
Pipe unit cost ($/LF)	$ 309.98